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PHYSICAL AND OCCUPATIONAL
RE-EDUCATION OF THE MAIMED

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PHYSICAL AND OCCUPATIONAL RE-EDUCATION OF THE MAIMED

BY

JEAN CAMUS

WITH THE COLLABORATION OF

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WITH ARTICLES ON BRITISH INSTITUTIONS BY

SIR ARTHUR PEARSON, BART., MARGARET SALE,
AND DUDLEY B. MYERS

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TRANSLATOR'S PREFACE

WHILE reading this book, which was recommended to me by Dr. Raoul Bensaude, of Paris, as the most complete French work dealing with the re-education of the wounded, I was struck with the idea of translating it, in the hopes of it being of some little assistance to those in charge of re-education in this country. To make it more complete, four chapters on the work being done in England have been added as an Appendix: one on St. Dunstan's, by Sir Arthur Pearson; one on Lord Roberts Memorial Workshops, by Miss Margaret Sale; one on the results obtained at Roehampton, by Mr. Dudley S. Myers; and one on the chief types of artificial limbs in use in England.

Recently an Allied Conference was held at Roehampton dealing with the re-education of the wounded and the various artificial limbs supplied. The Conference covered the same ground as this

book, but for those who could not attend an account of French methods may be useful.

My best thanks are due to Messrs. Baillière, Tindall and Cox for their courtesy, and for the great assistance they have rendered me.

W. F. C.

H.M.S. " ———,"

September, 1918.

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PHYSICAL AND OCCUPATIONAL RE-EDUCATION OF THE MAIMED

CHAPTER I

PHYSICAL AND OCCUPATIONAL RE-EDUCATION

I.—Psycho-therapy and Physio-therapy in Re-education.

THE simplest voluntary movement calls for some of the most complicated syndromes known to physiologists. For its accomplishment there must be perfect co-ordination between the cells in the cerebral cortex, their various connections in the brain, and the tracts running through the spinal cord. The peripheral neurone and nerve-ending must also be intact, as well as the muscle itself, with its sensory nerves, its bone and neighbouring joints. Anatomical continuity is insufficient of itself. It demands the addition of that exciting force which we call Will, which itself is a complicated mixture of experience stored up in the brain. If any one of these essential elements is at fault, then the simplest movement will be clumsy, fail in its purpose, or be absent altogether.

In considering re-education, be it physical or occupational, all these essential links in the chain must be borne in mind. The motive power, the sensory tracts, and the personal psychology of the patient, are of equal importance.

Recent studies in apraxia have shown the complications of voluntary movements in the psychophysiological scheme; the neurologists have divided the clinical forms of apraxia into three classifications, corresponding to the different phases observed in voluntary action. Thus, disturbances can take place—

(1) During the conception of the movement (*L'apraxie idéatoire* de Liepmann).

(2) During the reaction-time, when the conception of the movement is followed in the brain by a vision of the act to be accomplished (*L'apraxie motrice* de Liepmann or *ideomotrice*).

(3) During the realisation of the vision (*L'apraxie kinétique des membres* de Liepmann).

Heilbronner would call the second group "transcortical" and the third group "cortical." These types have well-marked characteristics. Foix observes that ideatory apraxia gives the impression of mental trouble, while ideomotor apraxia only gives the impression of clumsiness. It must be remembered that in these types there is neither paralysis, ataxia, anæsthesia, or pain, and the patient is quite capable of recognising various objects. Some stress has been laid on these clinical

entities in the hope of drawing attention to the psycho-physiological complex, which is too often forgotten in physical and occupational re-education.

It is by no means sufficient to send a disabled man to an institution and tell him to work for five minutes daily at various forms of apparatus, or to fix one of his limbs in a powerful machine for flexing and extending it. This does not constitute physical re-education, any more than the sending of a former stone-mason to learn typewriting constitutes occupational re-education.

Psycho-therapy should play a most important part. One must not order a patient physio-therapy in the same way as one would prescribe quinine! A patient with malaria is benefited by quinine whether he wishes it or not, but a man disabled by wounds will not benefit by mecano-therapy unless he puts his heart into his treatment. An intelligent and conscientious patient requires to understand what he is meant to do, and will benefit to a greater extent if he is quite clear as to the purpose of his exercises and the progress he is making.

A man who has been maimed in the war comes up for treatment full of zeal to be made quite fit again. The reasons for this enthusiasm are various. One man may come up from a desire to fight again; another from fear of becoming a chronic invalid; another because the doctor tells him that the more trouble he takes with his exercises the quicker he will get well; another may be afraid of being

punished for being lazy. Many and varied are the motives underlying the zest to get well, and it is the doctor's duty to discover each man's motive and to encourage him.

He must inspire confidence, without which, perseverance through a long and tedious treatment is unlikely. All doctors know of cases of stiff fingers, where the massage treatment has been persevered in, but which never get better because the patient is afraid to move them at other times. On the other hand, many are the cases with a result more favourable than could have been hoped for, judging from the destruction of tissue, which are solely due to the perseverance and faith of the patient. I have seen limbs, shattered beyond belief, regain nearly normal function through the faith of the patient. This personal factor is worth more than any electricity, heat, or vibrations, as, being constantly present, it urges the patient on to overcome his disability.

One principle in the treatment is of the highest importance—the patient must desire to get well and to start work again. It is the doctor's duty to point out to the patient, in the most suitable way, his own interest and, above all, his duty to his country. This lies in the sphere of psychotherapy, and should be well to the fore in every conversation between the doctor and his patient. The writer has adopted this idea extensively during many medical boards. Some men need encourage-

ment, some compliments, some a promise of leave, and others threats and warnings. The writer encouraged these boards purposely as part of the patient's treatment.

Professor Dejerine in his psycho-therapy clinics shows his patients men who were most severely wounded and disabled, but who by perseverance are now cured. The same idea is useful in dealing with re-education. A man with a badly smashed arm, covered in scars, is proud to show how well he has been taught to use it and how useful it is to him, and what better example to persevere can be shown to men about to start treatment? For the same reason, in all our workshops we retain a few men who have become expert workers, although they have been badly mutilated. Psychic influence takes a prominent part in the scheme of re-education; nothing else counts as much. Some of the wounded are impressed by the size and movement of the apparatus designed to cure them, which in itself is a good thing; while others regard it with suspicion and scepticism, and it is in this latter class that gymnastics and walks in the country produce so much benefit.

II.—A Few Principles in Occupational Re-education.

Environment.—The simplest plan is undoubtedly to place the man in a good workshop in a town, and to find a good teacher for him. The latter

may be paid if necessary, and the patient given a living wage until his re-education is complete. This method, seemingly so simple and practical, has not yielded the results we hoped for. There is really nothing very surprising in this, as since the main object is to teach the man to earn his living as quickly as possible, it follows that the patient must devote his whole time to his apprenticeship. This is impossible in an ordinary workshop, as the teacher is unable to sacrifice his whole day to the individual. A special school for re-education, with many different workshops, solely for the use of the mutilated, offers the best and quickest training. The products from these shops should be of secondary importance. In a school fitted out in this way, teachers and pupils devote their whole time to one object—re-education. Another question presents itself: Should the patients live in or out? Those who have good homes should be allowed to return there every night, whilst the others should be accommodated on the school premises.

The Time to start Re-education.—Is it advisable to wait till the patient be discharged and his pension fixed, and he be fitted with his final artificial apparatus? There is only one possible answer to this: As soon as any scar-tissue present is firmly organised, re-education must be started without any loss of time, so as to obtain the best possible functional result. Thus, most often the professional

training and medical treatment are most profitably carried out simultaneously. Medical supervision is probably necessary if the patient's training starts before his wounds are healed. This method has seemed so important to the Ministry of Health that workshops have been erected close to the hospitals, in which patients can profitably spend their leisure hours. In this way men, who later are to be discharged, can learn a trade while still under the doctor's care. This system is of special benefit to men suffering from peripheral nerve lesions, in which the treatment is always so prolonged.

Medical Entrance Examination—Physical and Mental State of the Wounded.—The importance of this examination cannot be overrated. By its means the doctor can satisfy himself as to the class of work the patient can do, and whether that work can be done 'standing or sitting. Arthritis, sub-acute inflammation of tendon sheaths, neuritis, muscular contractures, the presence of foreign bodies, sequestra which are being shed, must all be carefully looked for. Any one of these conditions may cause serious trouble if active and passive movements are started too soon.

Consumptives, syphilitics, and alcoholics must be excluded both in the interests of the doctor and of his other patients who are working in the same shops. Of course, in the case of alcoholics much depends on being able to cure them of their

habits; also their personal character must be taken into account, as in some cases it may be possible to let them mix with the other patients.

The wounded man's mental condition should be the subject of close study. Bourrillon, Borne, and Carle have repeatedly insisted on this point. Many of the patients, in spite of what they have been officially told, still have at the back of their minds the idea that if they prove themselves able to work their pension will be reduced. The doctor must impress on them the fact that the amount of their pension is fixed by the amount of their disability, and not by their earning capacity. An ankylosed knee or an amputated thumb entitles its possessor to a definite gratuity, irrespective of whether he happens to be a pauper or a millionaire. There is another class of men who have to be put into the right way of thinking; these men are obsessed with the idea that once they have been wounded it is the State's duty to feed, clothe, and lodge them for the rest of their lives, and that there is no longer any necessity for them to do any more work. Some patients come to be trained because some rich man, who takes an interest in them, has sent them, and they are afraid to refuse for fear of offending him. The doctor must discover these various states of mind, and impress on all the patients the urgent necessity of making themselves fit to occupy a useful place in the community.

Artificial Limbs.—On first seeing the patient, the doctor must carefully examine any amputation stump present and the suitability of any instrument supplied. He must also satisfy himself clearly as to the amount of disability (if any) present with regard to the career chosen. One often sees a man in the workshops laying aside the instrument he has been supplied with, and the chances are that probably he is right in so doing.

Take, for example, the case of a musculo-spinal paralysis: in this an instrument which is most useful for one kind of work will only get in the way for another kind. Many artificial limbs are quite useless owing to their complicated fittings. An artificial hand suitable for one class of work may be useless for another. An artificial hand must have three qualities—(1) adaptability, (2) strength, (3) it must be easy to put on or take off. This latter condition seems, happily, to have been solved. It is so very easy to delude oneself as to the progress made in artificial substitutes for the upper limb, but so much work has been done recently on this subject, all over the world, that improvements must have been forthcoming. At the present time the best plan, in dealing with a man who has lost his right arm or hand, seems to be to train him to use his left as the master arm, and the right, with its apparatus, as a help.

Choice of an Occupation.—In this, of course, much depends on the physical disabilities present. It is

much better that the man should return, if possible, to his former trade or calling, but if this is not possible he should be trained to do something in close connection with it. In the years preceding his wound, he has stored up in his brain the knowledge of his trade, which makes him a specialist in it. Take, for instance, the case of a man who for some years has been a cabinet-maker. He has trained himself in the use of many special instruments, chosen according to the grain and hardness of the wood he is working on. Subconsciously all his past experience is called into play, without which he is only an unskilled apprentice. This store of knowledge, that makes him a skilled workman, has come to him unconsciously during long years, and shows itself automatically in his work. It is decidedly not to this man's advantage to allow him to set aside all this technical skill and acquire another trade for which he may have taken a passing fancy. For this reason we try to turn a former carpenter into a cabinet-maker, a slater into a tin-smith or plumber, a blacksmith into a mechanic, a house-painter into a carriage-varnisher, and so on.

The only exception to this rule of finding a man similar employment to his pre-war work is when his former calling was distasteful to him or useless to the community. For instance, to take a man away from his previous occupation in a public-house may save him from a cirrhotic liver and his children from an alcoholic heredity. On the other hand, the

wounded man's incapacity may be the means of improving his social position, as in the case of an intelligent stone-mason who was taught designing, and who became a contractor with his own yard. Cases like this are by no means uncommon. Apart from any disability caused by the wound itself, we must take into consideration the sensation of fatigue that is felt in regions far removed from the seat of injury. Bloch has shown in his researches the diversity of positions in which fatigue is felt. In a baker it is in his legs; in a blacksmith, not in his arms or shoulders, but in his back; in a bootmaker in his back and abdominal muscles; in a young soldier, even when marching without his haversack, it is in his neck; in a violinist also in his neck; in a roadmender, who uses a pick, it is in his legs. Bloch affirms that fatigue is most felt in those muscles which do not come into play during the work. These "points of least resistance" must be considered when dealing with men disabled by wounds.

It is always advisable to consult the various trade organisations as to the demand for labour from time to time, and to choose an occupation for the man in which there is likely to be a continuous demand. It is better to avoid the type of work in which women are predominant, such as typewriting and shorthand.

Another point often forgotten is that of asking the parents of the patient for their consent before

definitely deciding on a trade, as a man with a small business in a provincial town would probably like to have his wounded son with him to help him, if possible, instead of seeing him turned out into the world as a professional photographer or a patten-maker. At the present time there is a great demand for steelworkers and mechanics, but it is as well to point out to the wounded man that the high wages in these trades are but ephemeral and that competition is severe. Just the opposite can be said about work on the land, which in most cases offers the disabled man the best opportunities. There is a constant demand for expert workers on the land, such as milkers, cheese-makers, bee-keepers, gamekeepers, and mechanics for agricultural tractors. These professions are suitable for men who like country life, but who are not strong enough for hard work.

Combined Re-education.—To teach a man a trade is not sufficient; it is equally necessary to find out if the village or place to which he is attracted by ties can offer a sufficient demand for his work. Take the case of a bootmaker who is going to return to his family in a village of, say, 300 souls: before letting him go, we teach him the elements of harness-making; while in the case of a clog-maker, we teach him, if not to make new shoes, at least to be able to repair old ones. It is as well to teach these men some hobby, such as gardening or bee-keeping, so that, apart from their main work, they can earn a little extra, which all helps to bring up

a family under decent conditions. Many of our patients are sent from the workshops to a short course at an agricultural school before sending them into the country. In this way we aim at setting loose all over France a number of men with small-holdings, who will once more prove themselves France's strength.

Theoretical Instruction—Taylor's and the Graphic Methods.—At the present time speed in teaching is essential, and any method, however scientific, which prolongs instruction must be laid aside. Practical instruction alone counts, but scientific theories should not be completely ignored.

All agree that a man who is working in the shops should be taught reading and writing if he is illiterate. In nearly all the workshops a teacher with a blackboard is a most useful adjunct, as a short lecture, besides its instructive value, gives the men a chance to rest their muscles. This interval, be it a quarter or half an hour, gives them time for thought, and questions from both sides are encouraged. The men can either take notes at the time, or a *précis* is given them afterwards.

Taylor's method gives the men the best chance of becoming interested in their subject. In it certain difficulties are sure to be met with, as it presupposes the fact that each man is of the same temperament and makes no allowances for any differences. Let us take, for instance, a musculo-spinal paralysis, an affection which has definite

symptoms. In a series of cases of this particular trouble many men depart from the normal both in symptoms and after-history, and it seems impossible to lay down one rule of treatment for the whole series; each case must, in fact, be treated individually. Taylor strives to turn all his patients into factory workers, although it has been repeatedly shown how much more suitable some of these men are for work on the land. Some critics are found, however, who approve of this method, misleading as it is both in theory and in results. It would be interesting to compare two series of men, chosen, as far as possible, with the same disabilities, trained by the two different methods.

The graphic method also has its advocates. It takes human nature into consideration, and is admirable in theory, but in practice its technique is difficult. In it the men are thoroughly trained, not only in their trade, but also in its various branches, and it is because of this fact that any criticism of it must be most moderate. We may well ask, "Is this thorough education absolutely necessary, and is it of sufficient value to justify the time spent on it?" And the answer in both cases seems to be in the negative. We should most certainly pause before putting this theory into general use. In it, to obtain the best results, the teacher must be both doctor and physiologist, as well as have an expert knowledge of the factory.

The Influence of Occupational on Physical Re-education.—That physical re-education is benefited immensely by occupational re-education is now generally admitted. Some critics have based their opinions on experiments, others on the fact that in any case it is a logical conclusion. We have tried to prove this theory by actual experiment. Drs. Nepper and Vallée have, at our request, carried out numerous researches with the ergograph on trained and untrained men. A series of men with injuries to their arms were divided into two groups. One group was trained to work and the other was left untrained, and the results were most conclusive, as the article written by these doctors will show. Working on the same theory, we took records of the measurements of the injured limbs of the men working at the various agricultural depots, just before the men left to help with the harvest at their own homes. The men were given four weeks' leave, which was long enough for any improvement to be noticed, and on their return all the measurements were repeated. The results were not uniformly satisfactory, as improvement seemed less frequent among those who were allowed home than amongst those who were working under supervision. Of course, this supervision is necessary for two reasons—(1) to see that the men really did work, which they often did not do when they were sent home; (2) to see that the kind of work done is suitable. This latter is most important, and we wish

to impress the fact that work does not take the place of massage or other therapeutic measures, but that both should run concurrently. Without medical supervision numerous minor complaints, such as arthritis, osteitis, synovitis, etc., which are the sequelæ of the wound, assume important dimensions.

The Time required for Occupational Re-education of the Wounded and their Pay.—The length of time must depend on various causes. The severity of the wound, the man's intelligence, the trade he is learning, and his previous knowledge of it, if any, have all to be considered. Generally speaking, six months is a good average, as in this time most men can be taught to earn a living wage. Owing to the various trades taught, it is difficult to fix a standard wage for men under training. It is, however, an ideal to be sought after, and in any case the men should be paid something. Usually they start at a penny an hour, rising to twopence. Each group of workers should have a foreman, who, if possible, should himself be one of the wounded having had previous experience in the work which is being taught. These foremen should be encouraged with higher pay to take an interest in the success of the work.

Finding Places for the Men when Trained.—Each man on becoming efficient is given a certificate. During his training he is advised to keep in touch, as far as possible, with his previous employer, either by letters or visits, if the latter are practicable.

An employer can often offer his former workman a suitable position, and in this way the man's training can be carried out with this end in view. This, of course, greatly simplifies the problem of finding a position for the discharged man, a problem which daily becomes more difficult to solve.

It is essential, rather than teach the man to use an artificial apparatus, to make the apparatus especially adapted to each case, making alterations wherever necessary. All these details are now nearing solution.

Dr. Kresser insists on the advantages gained in letting these men work together, diluting them with able-bodied workmen for any of the work the maimed cannot accomplish. Another good plan is to mix a number of men with injuries to their arms with a number with injuries to their legs.

It is important to find a sound solution to the financial difficulty in setting these men up as independent workers. Swiss law gives men who are injured at their work a lump sum as compensation; in spite of the many obvious disadvantages of this plan, it is found that a man becomes more quickly accustomed to his disability, as he starts immediately to settle down to earn his living once more, even though it may be in a modified form.

Although this plan does not appeal so much to us in France, it is obvious that the really industrious men could soon settle down to some new calling or trade with the money provided, and that in the

long run the country would not suffer from having given them a capital to work on. With us in France several societies are already in existence, and new ones are being formed daily, to help find positions for discharged soldiers, and it is a work that deserves in every way State encouragement.

CHAPTER II

**PROFESSIONAL RE-EDUCATION OF MEN WHO
HAVE UNDERGONE AMPUTATIONS**

WHEN a man who has undergone an amputation asks for advice as to the choice of a career, several points must be considered. Of these, undoubtedly the most important is that the man must be physically able to do any work that is suggested; other points that call for consideration are the man's social standing, his intelligence, his previous occupation, and his general state of health.

It is obvious, in dealing with lower limb amputations, that the more efficient the artificial leg is, the greater number of industrial or even agricultural occupations are open as professions; besides, there are countless trades in which men sit while working, or only occasionally stand, and in which a man with one or even two artificial legs is at no disadvantage.

It is quite another matter in dealing with an amputation of one or both arms. A man with both arms removed finds it hard to earn a living without charity. Often, in the case of an amputation at the wrist, forearm, or shoulder, the patient

will have as much difficulty in choosing a profession as the surgeon has in advising him.

The surgeon must adopt one of two plans. Either he must advise the man to make the most of the skill and strength left him, or, if these be insufficient to allow him to follow a useful trade, he must devise some artificial means to enable him to do so. In many cases these two methods are complementary, but in spite of this many surgeons are inclined to pay more attention to one or other of them. Personally, I believe the first gives the better results in a general way. I say "in a general way," as in dealing with these cases there can be no hard-and-fast rule; but I have so often seen men who have lost a limb performing marvels of skill that I am inclined to favour the mental and physical side rather than the artificial. It is very important to realise that the man must not merely be taught how to do his work, but that he must become sufficiently proficient to allow him to earn a good wage for himself and his family.

A man who has lost a limb can only with difficulty be persuaded to use an artificial substitute, as he prefers to throw the whole of his work on to the sound limb rather than make himself conspicuous in his attempts to become proficient in the use of his artificial one. Let us take, for example, the case of a carpenter or a mason who has had his right arm amputated. After a careful examination, the surgeon can say to him: "You have two sound

legs and a left arm, which has only to be trained and exercised to become as useful as your right arm used to be. Get on with your training and exercising, and give no more thought to the arm you have lost. If there is sufficient stump left to help you in your work, use it by all means, but learn to work even without it. Physically and mentally you are capable, if you only try, of learning any one of a number of trades. You can become a draughtsman, a surveyor, an architect's clerk, a small trader, an accountant, a commercial traveller, or a foreman in some works, on a farm, or in a mine."

The objections to this method are fairly obvious. In it you take a man who in one trade is a skilled worker, and you make him into a beginner in another trade, at a time when the country is calling for skilled workmen of every kind. On the other hand, fit this man out with the best artificial arm possible, and put him back in his previous occupation, or one closely allied to it, and what happens ? He is no longer a skilled worker, however good his artificial arm may be, and so he will find difficulty in getting employment. Being discouraged, he will degenerate physically and mentally, and the last state of the man will be worse than the first.

How can we actually enable him to do manual work again ? By an artificial arm ? Has any arm yet been invented, be it French, American, or even German (and we know the Germans have devoted

much time and trouble to the question of artificial arms), which allows of anything approaching natural movements? In actual practice, the only serviceable method is to train the left arm to take the place of the right, and the artificial arm to take the place of the left. Having trained the man in the proper use of his arms, the first difficulty that presents itself is that much of the machinery in everyday use is unsuited to a left-handed worker, and has to be altered. This is not the only difficulty, as the left arm must continually stop its work to assist the artificial one, which, having neither muscles nor nerves, has constantly to be adjusted in the various positions. Each time a change of tool is necessary the left arm must come to the assistance of the right; and as this changing of tools is continuously necessary amongst carpenters and masons, the time lost seriously affects the man's value as a workman, even allowing that he can do the work.

What is not so easy to realise, perhaps, is that these delays are a constant source of annoyance to the workman. True, a few picked workers will persevere, especially if they are kept for show purposes to encourage beginners, but most men will soon stop work in disgust. A neutral surgeon, in a most interesting report, tells us that, disciplined as the German soldier undoubtedly is, men with one arm desert in shoals from the schools where they are taught to believe that the arms the Kaiser supplies are equal to those provided by Nature.

The general tendency of broken men to drift towards an easy job is well known. It was chiefly with a view to combating this tendency that in a recent publication entitled "The Re-education of Our Wounded," I insisted so strongly on the moral aspect of the duty that these men owed to themselves and their country. Daily one sees examples of men who, however well they may mean, do not in the least realise the importance of this duty. Also, I consider it wrong to let these men believe that, when they have their artificial limbs, they will be able to lead as active and energetic lives as they did before they were wounded, as by telling them this they only suffer great disappointment.

Just as it is important to urge these men to make an effort, so is it equally important to make this effort as easy as possible, so as to counteract the unutterable feeling of impotence that men who have lost their right arm so often experience.

It is easy to understand why these men always prefer a simple apparatus to a complicated one, which in many cases becomes merely an instrument of torture and annoyance. With amputations of the hand or forearm the problem is easier, as the elbow movement is so useful, but gripping, pronation, and supination are all movements which call for the help of the other hand.

Work that does not vary very much or call for a constant change of tools can, in my opinion, be

well carried out by some artificial arm of simple construction. This is the case in the work of turners and woodcutters, and most particularly the case in agricultural work. Many agricultural labourers, fitted only with the simplest form of hook or ring-bolt, modified to fit their tools, can accomplish the greater part of the ordinary work in the fields, such as pitchforking, ploughing, raking,



FIG. 1.—IRON SHEATH USED BY HARNESS-MAKER.

digging, etc., even without the help of specially designed tools. Many are the instances of men who have lost an upper limb earning a good living in the fields. Would that this were generally known, as men broken in battle are often averse to working on the land.

Many are the devices and tricks which can be used in their work to make up for the loss of a limb—devices which the unamputated workman would

never think of using, but which to the maimed are invaluable. For instance, there is a man who had his leg amputated at the thigh in 1870, and who, by fixing a sabot on to the end of his wooden stump to prevent it from sinking into the soft ground, has succeeded in making a comfortable living for himself by working in the fields.



FIG. 2.—HARNESS-MAKER, WHO HAS LOST HIS LEG AT THE THIGH, SHOWN AT WORK.

There is also the case of a harness-maker who had an amputation through the thigh, and who only had a short stump left. He devised a metal casing (Figs. 1 and 2) for his stump, and by placing the harness between that and his sound limb was able, by exerting pressure, to grip it sufficiently firmly to be able to work on it. This idea has been

taken up and developed in the workshops at St. Maurice.

In the case of bootmakers who have lost their legs, it is found that a wooden support enables them to hold their work on their knees better than any artificial limb can do.



FIG. 3.—BOOTMAKERS AT WORK, SHOWING PROPS USED.

There is an unlimited quantity of these devices, which are much more serviceable than any artificial limb, and which it is our duty to discover and publish in order to help our limbless patients.

In conclusion:

1. In leg cases an artificial limb is only of secondary importance, as in most cases it is easy to find the patient work which does not call for the use of his legs and which brings in good wages.

2. In arm and shoulder cases it is better to make the greatest use of what remains of Nature's limbs rather than to rely on an artificial arm to do work for which it is usually quite unfitted.

3. Similarly, as regards men who have lost a hand or forearm, it is often wisest to fit no artificial device at all, but in some cases an apparatus, be it a simple hook hand or a complicated piece of workmanship, will enable a man to resume his former occupation at a good living wage.

4. In all amputation cases it is important to find an occupation which is not too arduous, either mentally or physically, as if the man finds his work irksome or disagreeable, he is liable to give it up in favour of something easier, even though he loses money and training thereby.

5. For this and many other reasons concerning both the patient and the State, artificial limbs should be simple, light, and strong. In many cases all that is required is a slight modification of the tools in general use, assisted by the various devices invented by the ingenuity of the patients themselves.

CHAPTER III

**OCCUPATIONAL RE-EDUCATION AFTER
VARIOUS INJURIES**

AMONGST the most important questions in dealing with men broken in the war is that of finding them suitable employment. On the choice of an occupation for them will depend the success of their re-education; hence every available means must be used to assure a successful choice. The surgeon must realise that there are no hard-and-fast rules, and that every case must be judged on its own merits. Even the amputation itself must not be allowed to prejudice his advice, but he must take a wide view of all the surrounding circumstances. Above all, a thorough physical and mental examination is most necessary before any advice can be offered. During the past year, while I have been attached to the Belgian military re-educational centre at Port-Villez, I have often tried to classify the various amputations and the subsequent trades chosen by the patients. Each time I have failed in my task, the reason being that similar wounds have very different functional results, and that it is quite the exception for two men with identical

wounds to have the same capabilities when they are discharged. All the same, I have often asked myself whether I should not publish some statistics on my fifteen months' experience at Port-Villez, where at any time there are more than a thousand men being re-educated. This experience is the only credential I have for writing this chapter.

Men who have lost an upper limb are without doubt much the most difficult to re-educate; only very occasionally can they even think of returning to their pre-war work. All or nearly all have to have new work found for them, and unfortunately many trades are absolutely closed to them.

Without denying for one instant that some men, gifted with more than usual pluck and fitted with an artificial arm of exceptional quality, can perform apparent miracles, one must consider the average man rather than the exception. For this reason, in order to get the best results, I consider that, with only one or two exceptions, men who have lost an arm or a hand, or who have some permanent brachial paralysis, should be trained in the use of machinery that only requires one arm to drive it, and should have their attention turned away from any manual work.

Proceeding on these lines, whenever a man who had lost an arm came for advice, if he showed any intelligence and previous knowledge of bookwork, and was not too old, he was advised to study in order to fit himself for some minor administrative post.



FIG. 4.—VIEW OF THE HUTS AT THE BELGIAN MILITARY RE-EDUCATIONAL CENTRE, PORT-VILLEZ.



FIG. 5.—FITTING SHOP AT PORT-VILLEZ.

The probability is that after the war numerous positions will be reserved for these one-armed men. The State, the various town councils, and also the big financial and commercial houses, will try to employ them whenever possible, and they should start being trained for this work without delay, in order to pass any entrance examination that may be required.

With this end in view, the Belgian Government have organised classes at Port-Villez for these men, where they can learn the duties of officials, bank clerks, accountants, etc.

No distinction should be made between men who have lost either the right or the left arm, as both groups can easily be taught to rely on the remaining one. We have a special writing class for men who only have their left arm remaining. At Port-Villez, out of 83 arm amputations, 25 work in the literary section and 58 in the workshops. There is no fixed rule for choosing a calling for these men; it is necessary to bear in mind that whatever occupation is chosen the man must be capable, if not of becoming an expert, at least of earning a good living wage. As an example of the various trades taught the men, those who are not very intelligent are instructed in French polishing, country-folk are taught farming and dairy work, and men who are skilful in the use of their remaining hand are taught printing, photography, drawing, and painting.

Thanks to the various improvements in artificial

arms, we find we can put fitters back to their old work, and at the present time we have in the fitting shops seven men who, with the help of good artificial arms, are doing work which gives ground for great encouragement.

In re-educational matters the most interesting cases, apart from those who have lost an upper limb, are the men who have been badly wounded



FIG. 6.—TOY-MAKING SHOP.

in their arms. These wounds are so varied that it is not possible to give a complete and classified list of them in this short chapter. I cannot satisfactorily place in one single group men who have some slight functional disability, such as the amputation of one or more fingers, with the thumb remaining, with those who have a claw hand, radial paralysis, paresis, pseudo-arthritis, total or partial

ankylosis of wrist, elbow, or shoulder, etc. The following various trades are taught at Port-Villez:

Boot-making.	Linotyping.	Carving.
Saddlery.	Printing.	Porcelain and glass
Tailoring.	Architectural draw- ing.	painting.
Basket-making.	Pattern-making.	House-painting.
Brush-making.	Wood-carving.	Imitation wood and marble painting.
Carpentry.	Stone-carving.	Letter and sign paint- ing.
Polishing.	Cane-working.	Butchering.
Sabot-making.	Electricity.	Baking.
Carpet-making.	Tin-working.	Poultry-keeping.
Fur trade.	Zinc-working.	Bee-keeping.
Hairdressing.	Lead-working.	Horticulture.
Photography.	Mechanical fitting.	Dairy work.
Engraving.	Motor-driving.	
Lithography.	Watch-making.	
Binding.		

Men who have lost a leg have a great advantage over those who have lost an arm, as there are such a large number of possible occupations for them. Without mentioning the numerous administrative posts open to those who show any intelligence, our workshops, especially those for boot and basket making, are full of men who have lost a leg in the war. All the same, it is a mistake to imagine that these men can only do work in a sitting position; we know from experience that they can stand at their work all day without feeling undue fatigue. For some months now one-legged trimmers and carpenters have been doing just as good work in the shops as men with two legs.

As to men who have not lost a leg, but who are functionally incapable of using one of their lower limbs, the trades open to them are countless.

After this brief survey of men who have arm or leg wounds, I must say a few words about those who have been wounded in the head or body. Men who have been trephined must be considered according to any limb paralysis or paresis present, and must



FIG. 7.—WORK IN A QUARRY.

be treated accordingly. If there is no motor or sensory defect as a result of the head wound, then careful search should be made for any cerebral trouble. Any occupation which involves the use of dangerous machinery should be avoided, owing to possible attacks of vertigo, and the same applies to any work that has to be done at some level above the ground, such as house-painting.

In dealing with body wounds, the main indication is to avoid advising any work which by its nature and the attitude it calls for can in any way irritate the scar of the wound.

In conclusion, I consider there are very few cases indeed who cannot be taught to earn a living wage, and it is our duty to see that men who have done so nobly in this war should be a source of pride and prosperity to the country when peace is declared.

CHAPTER IV

RE-EDUCATION OF THE BLIND

TRENCH warfare has undoubtedly increased the proportion of head wounds over others, as in many cases the head is the only portion exposed to enemy fire, and the same holds good, of course, of wounds in the eye. Whatever the cause of blindness, be it section of the optic nerves, or a bullet passing through both eyes, or small fragments of shell perforating both eyeballs, it must be recognised that in no other war has blindness occurred in such large proportions. Without doubt, the loss of both eyes is relatively small compared with the loss of one eye (4 per cent. according to the latest statistics), but even then there are over 1,800 men who at the present time have lost the sight of both eyes. This is all the more deplorable, as many of these cases should have been avoided, and undoubtedly will be prevented in the future, by the use of anti-shell splinter goggles which Dr. Cousin and I have recommended. Statistics show us that three times out of four the loss of the eye is due to the penetration of a small foreign body (be it a piece of metal or a fragment of stone thrown up by a shell-burst),

and this could be guarded against by a thin metal perforated plate before the eyes. The model recommended has two slits, one vertical and the other horizontal, and gives sufficient protection for the eyes whilst allowing for a good field of vision; a rifle can easily be aimed while wearing this protection.

The general adoption of this protection would undoubtedly diminish the cases of blindness by three-quarters, and it is to be hoped that its general use will not long be delayed.

In the meanwhile we must do our best for those men who have been blinded. The Association Valentin Haüy, which in peace-time did so much for the blind, has risen nobly to the task of teaching wounded soldiers to lead a useful life. Various trades are well suited to the blind, and amongst these are brush and basket making of every kind, mattress-making, boot-making, piano-tuning, massage, and many others calling for purely manual work. Some of these, such as piano-tuning and massage, require as well some degree of intellect.

The greater number of these occupations have the advantage that they can be practised at home. A word of thanks must here be accorded to M. Brieux, of the Académie Française, who has devoted all his energy to the cause of the blinded soldier; he saw at once how much better it would be if these men could learn trades which they could carry on at home. With this end in view, many

re-educational centres have been established for the blind, each one near some ophthalmic hospital where medical attention is obtainable.

M. Brieux particularly emphasised the fact that blind men do better in every way if they are among familiar surroundings, as use is in this way made of their memories, instead of their having to learn their way about by touch and hearing. For this reason we keep these men at school for the shortest possible time in which they can learn their new trade; this length of time varies, of course, with the trade which is being taught. Out of a number of blinded soldiers, we find on an average that five-tenths learn to farm, two-tenths to be workmen, and the remaining three-tenths learn various other occupations. Whatever career is chosen, the teacher must be careful not to let the blind man know how much he feels for him; so many people who come into contact with the blind for the first time make this mistake, and so sap the blind man's courage.

It is amazing to find such a large proportion taking up farming, as at first glance this does not appear to be a suitable occupation for a blind man; however, a man who has lived on the land all his life undoubtedly does much better by going back to it in his time of trouble. By so doing he returns to his old house, and soon makes himself useful in doing various jobs, such as cleaning out the yard, milking the cows, digging up the beets and potatoes and putting them into heaps, tossing the hay, etc.

So many of our blinded soldiers have proved themselves able to go back to part, at any rate, of their work on the land. In wet weather and in their spare time they can do a little brush-making.

Besides, in dealing with these men, the point to remember is not to train them to compete against those who can see, but to train them to earn a living wage, which, together with their pension, will enable them to bring up and support a family.

This pension is 975 francs, together with an extra 100 francs for the Military Medal (which all blinded soldiers get), and probably another 225 francs when the old pension law of 1831 has been brought up to date. A blind soldier thus gets 3.55 fr. a day, and this, together with what he earns, should, if he is at all industrious, equal the wage of a man who has the use of his eyes.

Apart from the provincial schools, mention must be made of the school for the blind in the Rue de Reuilly, Paris; this is a State school organised with the help of the Société des Amis des Soldats Aveugles. Here the blind man will find a workshop for each trade, as often as not under a teacher who is himself blind, and the blind man is instructed in making brushes, brooms, and barrels, in caning chairs, in making carpets, and in boot-making (which is a most suitable employment for the blind). If the man is married, his wife can be trained to help him with the difficult part of his work, and he then becomes nearly as useful as if he still had his sight.

Amongst the trades suitable for the blind, the making of ordinary brushes seems to be the best paid and the most useful one. Its advantages are—it is easy to learn, it only requires a simple outfit, and it can be done at home. An ordinary carpet brush is the best kind to choose. If the blind man works at an open window overlooking the village street, then all his neighbours will become interested in him and will buy his wares. The same remarks hold good, of course, for those engaged in chair and basket making, etc. The man's tools and materials can be bought for him when he leaves the training school out of the money he has earned there by his industry.

The study of writing and reading Braille is an essential part of the blind man's training. In this, too, the Association Valentin Haüy has rendered yeoman service; they have a library of 40,000 books in Braille, all attractive and easy to read. There cannot be too many books printed in Braille. The Association encourages people who are willing to devote some of their time to the interests of the blind to copy out into Braille various suitable books. The only outfit required for this is a perforated copper plate, made with regular divisions, and a piercer. One soon learns to write Braille fairly quickly, but it is a work requiring great patience, as only one copy of a book can be done at a time, and any mistakes in the text make the book very hard to read. Those who are willing to work for

the blind cannot be too strongly urged to use a little Braille printing press described by M. Vaughan, as by this means the work can be done quickly and carefully, and is much more paying, as there is no limit to the number of copies that can be taken off it.

One often wonders if Braille's system, which is the only one in general use, could not be improved. There is another system of using ordinary letters in relief, so that in this way a blind man is in communication with his fellow-sufferers by touch and with the world at large by sight. This at first glance seems a better method than Braille's, which can only be read by those who have been taught it; but this method is not practicable, in spite of the various ingenious devices suggested.

Mlle. Mulot conceived the plan of a guide which allows of the writing of ordinary letters with ease; this guide is a tablet of copper with a large number of windows or divisions, all of the same size and 8 mm. high. Each division has projections and depressions at the sides to give the blind man his sense of direction; the writer, by joining the various depressions or projections, can draw horizontal, vertical, or oblique lines, and can in this way trace the letters of the ordinary alphabet.

With a little imagination it can be easily understood how a printing machine can be adapted to raise the letters in relief. This system would be even better if it came into general use for those who can see as well as for the blind, and it is astonishing

how quickly the blind can assimilate reading and writing by this method. Several times since the beginning of the war we have had occasion to remark on this. Quite recently Dr. Monprofit insisted before the Academy of Medicine on the advantages of this relief-writing. These discussions would not be in the least necessary if this method were open to all, and could be read by the blind as well as by those who can see; but it is far from being as easy as this, as the blind continually tell us. Their teacher, who has tried both the Braille and the relief-writing methods, finds much more difficulty with the latter, which is always harder to read. In the blind there is much less adaptability in recognising any individual peculiarities in the handwriting, and it is because of this that Braille comes easily first in usefulness.

We would again draw attention to M. Vaughan's simple and rapid Braille press; in it each type has both an ordinary letter and the corresponding Braille letter, and so it is easy to set it up. It would be advantageous to set up one of these presses in each re-educational centre, so that in this way there would soon spring up an enormous library for the use of the blind, after they have left the various centres and are scattered all over the country.

CHAPTER V

**RESPONSIBILITY FOR ACCIDENT—WORK-
MAN'S LIABILITY**

PUBLIC or private societies for re-educating the wounded in their old trade or for teaching them a new one should not overlook the accidents to which these men are liable. Let us glance at the laws on the subject in so far as they refer to liability. There is no doubt that these societies come under the heading of charitable institutions, as they do not work for profit, and so are not liable for any accidents to the men at work, except in the exceptional case mentioned later. But even if these societies are not included in special legislation, they are none the less responsible under the common law for any mistakes that can be attributed to them or to the persons they employ to teach the wounded. For instance, if a house which is fitted up as a workshop collapses and injures the men working there, the society is responsible; similarly, injuries due to faulty material are attributable to the society. The societies are regarded by the law as the teachers and guardians of the wounded, and are held responsible for any faults committed by

them. For instance, in the case of an injury caused by one workman at his work to another, it is held to be due to lack of proper supervision on the part of the teachers, and similarly when the teacher himself is injured by a mistake made by one of the workmen; even if the injured man sued only his teacher, the society would be liable for him.

It seems only common sense to insure against these liabilities. Strictly speaking, the societies need only insure themselves; but as they are charitable institutions, it is kinder to insure the men also, although they need in no way accept responsibility for them or their instructors.

It is the society's moral duty to insure their workmen, so that even if they do not get full compensation, they at any rate get something for any accident that may befall them during their work. It is possible to take out a policy which will not only cover any civil liability, but which will also compensate the men for any accident that may befall them during their re-education. "Mixed policies" of this kind can be taken out with most of the insurance companies. These "mixed policies" include—

(1) A fixed sum agreed on in advance between the society and the company to cover various degrees of injury—*e.g.*, death, permanent or temporary, total or partial incapacity, and also the cost of treatment.

(2) Civil liability incurred against the society or its teachers.

(3) Legal indemnity for accidents according to the Judge's decisions in a court of law. This is only applicable where the society places the men at work outside its own premises, and where it takes charge of their earnings. Undoubtedly this is exceptional, but it is as well to be covered in all cases by insurance.

One realises that these "mixed policies" are more costly to the society than an ordinary policy; but, on the other hand, they are much more comprehensive, and are especially suited for societies that take charge of wounded men, as they cover the men's disabilities and loss of earning power resulting from accidents at their work.

The society has only to compare the premium demanded with that current for men engaged on similar work to see if it is excessive. The society would be well advised to insure all work done by the men, collectively instead of individually. Nothing is easier than for these societies to insure for their pupils material and moral security, and this is indeed their duty, as these men have sacrificed everything in fighting for their country.

CHAPTER VI

**RE-EDUCATION OF MEN WHO HAVE LOST
AN ARM**

THE fact that strikes one most, when looking at statistics, is the enormous proportion of farm-labourers who have been wounded. Undoubtedly these form 60 per cent. of all those who pass through our hands to be fitted with artificial limbs and taught to earn their living. For this reason we are devoting the whole of this chapter to this class of patient.

This is a critical time in the history of France; there is a great shortage of men to work the land, and it is our duty to remedy this shortage as far as we can, and the best way to do this is to make fit again those men who, before they were called up, used to work in the fields.

Too often these men, on their arrival at our school, have not the least idea of what they can do to help themselves. Most men who have lost an arm think that their stump is useless, and the revelation that comes to them is nothing short of marvellous when they realise that, with some sort of mechanical apparatus, they can dig and mow

and do work to which they have been accustomed all their lives, and which they thought they would never be able to do again. For though the towns attract many young men from the country, nevertheless, once a man has worked in the fields and learnt to love his work, he will always long to come back to it.

The Preparation of a Wounded Man.—A stump, to be useful, must be strong and supple; all the neighbouring joints should work freely; pronation and supination, in the case of forearm amputations, are as necessary as movement at the elbow and shoulder joints. The first thing to do with a stump is to get rid of the œdema which is usually present. When we have done this, we have advanced far towards getting a powerful stump, which can work without tiring, and consequently allow the man to put plenty of life into his task. Stiff joints and muscular atrophies must be energetically treated. At Dr. Amar's laboratory we have seen experiments carried out with his bicycle ergograph which confirm the results we ourselves have obtained in treating œdematous stumps (of the thigh) by mecano-therapy. We treat all arm stumps, if they are in the least œdematous, by regular massage, which includes the neighbouring articulations, and in this way we have obtained the most successful results.

We have converted Dr. Amar's apparatus for the leg for use with arm stumps, and this has in every

case given the stump increased power and strength; we have added rotary movements as well. In all cases gymnastic exercises are prescribed for the sound arm, especial trouble being taken when this is the left, in order to train the man to become skilful in using it.

It is well known that to make a man walk with a temporary apparatus on his stump is the best way of hardening it before making a permanent leg for him, besides being an excellent adjuvant to massage. The same applies to an arm stump, where work with some temporary apparatus soon strengthens the stump and gets rid of the œdema. The use of a temporary apparatus is also convenient, as it helps in the man's re-education during the time he is waiting for his permanent arm.

In Germany, where social discipline is as strict as military discipline, Spitzzy has created an enormous centre for artificial limbs, where the men are thoroughly re-educated physically and professionally before being discharged. Doubtless this system has many advantages, but it would not be suitable for France, where the liberty of the subject is held in high esteem. For this very reason we try to keep our patients in hospital for as short a time as is compatible with their complete re-education. Two months, the time usually required to fit an artificial limb, is usually sufficient to train a man to work on the land. We believe this training

could be done even quicker and more efficiently if the men were split up into small groups, care being taken to eliminate any men who have definite objections to work; in other words, individual is preferable to collective instruction. If possible, the teacher himself should have been maimed in the war. Lastly, as all work should be remunerative, it is advisable to let the men start earning wages as soon as they can use their apparatus.

To sum up, as soon as a man who has lost an arm arrives at our centre to be taught farming—

(1) He is persuaded he will be able to work on the land. This is done by conversations, individual attention, and showing him men suffering from the same disability at their work.

(2) He is provided as soon as possible with a temporary arm and tool-holder.

(3) He is set to work in special "experimental gardens," where he is stimulated by seeing his fellow-sufferers working.

(4) Care is taken that his final arm not only fits well, but is suitable for the kind of work he has chosen, and that it has a good assortment of essential "working hands," to use Dr. Boureau's expression. We must consider now—

(A) Temporary apparatus for agricultural work, designed for the use of one-armed men.

(B) Indispensable working hands.

(C) Standardisation of the hands.

(D) Results obtained.

A. Temporary Apparatus.—We have designed a simple apparatus which can be used either after an amputation through the forearm or upper arm. This apparatus is supplied at once to all men who are going to learn agriculture. As soon as the men have their final apparatus, the temporary ones are taken away to be readapted for others; all the same,

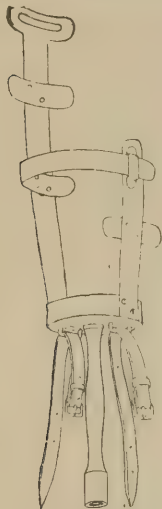


FIG. 8.—TEMPORARY UPPER ARM APPARATUS.

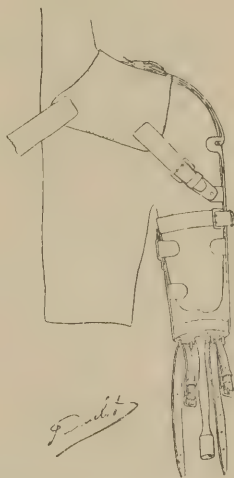


FIG. 9.—TEMPORARY UPPER ARM APPARATUS.

men often prefer their temporary apparatus to their final one, as they say it is lighter and easier to work with. In future they will be able to keep their temporary apparatus, as arrangements have been made with this end in view.

1. UPPER ARM APPARATUS—FIRST DESIGN (Fig. 8).—This is a tool-holder made of hard wood, sup-

ported by two metal splints, the outer one long and the inner one short. To each of these splints are fixed short curved horizontal pieces, one of which is long enough to encircle the stump. The two ends of this long piece are thus arranged: One end is fixed to one of the vertical splints, while the other end passes through a slot in the other splint. A shoulder piece, similar to that supplied with the final apparatus, keeps the whole in position. This tool-holder has a thread of 10/150, and has two straps, one on either side. The apparatus is kept in position on the stump by a webbing bandage; in dealing with a short stump, a complete spica is necessary.

Gillet's Working Arm.—This is an instrument which is much more highly finished, and which is really more than a temporary apparatus. The socket is made of aluminium, and from it rise three aluminium supports, the outer one of which is the longest and is fixed to the shoulder piece by an adjustable strap; while the other two (antero-internal and postero-internal) are joined at the top by another aluminium plate, which supports a small grooved pulley. Over this pulley, from the outer angles of the shoulder strap, runs a catgut cord, which can be regulated in length. This method of attachment is better than any other we know of, as a man with a stump of 2 inches can work with one shoulder quite free and mobile; the whole apparatus is fixed to the stump by one or

more straps. One point we must emphasise is that the whole usefulness of the apparatus thus described depends entirely on its mode of attachment to the shoulder.



FIG. 10.—FOREARM APPARATUS

2. APPARATUS FOR THE FOREARM (Figs. 10 and 11).—This is based on the principle of a wooden disc with two steel uprights, equal in length and projecting about 8 inches from the disc. From the ends of these uprights run two leather straps fixed to a brassard which supports the apparatus; a

cotton bandage over this keeps the whole accurately in position. The brassard is fixed to the shoulder by a little webbing, which crosses over to the other axilla. Although we have described these two particular apparatus, we do not claim that they are



FIG. 11.—MEN WITH AMPUTATIONS THROUGH THE FOREARM
AT WORK.

perfect, as we fully believe that other and perhaps simpler arms are just as useful; but we do wish to say that with these two types our patients have been able to do heavy work, and consequently their last weeks in hospital, while waiting for their

permanent apparatus, have by no means been wasted, since we have been able to complete their re-education, and to prove to them that they can and must go back to work on the land.

B. Working Hands for Field Labourers.—Much time has been spent in designing a suitable grip to take the place of an amputated hand. The first tendency, and one which is still fairly general, was to fit a universal grip for all purposes. From this have evolved numerous ingenious contrivances, such as Dr. Amar's, the Louis Lumière of Lyons, and the Estor; each of these is useful, as with a certain amount of skill and practice a man using them can work at a variety of trades.

But these contrivances are not of much value for agricultural work. Here we agree absolutely with M. Boureau, who believes that nothing can be universal, but that each class of work must have its special hand. Our experiments have been carried out under the same plan as those of M. Boureau; we have watched men at their work, have questioned them closely, and have finally evolved the apparatus which we shall describe. But first of all let us consider the tool-holders, some well known, and others adapted to meet particular requirements.

1. **M. BOUREAU'S HAND FOR DIGGING.**—After pointing out the numerous disadvantages of the classical ring hand, M. Boureau says: "I have tried to endow the ring with the mobility of the wrist,

to allow it antero-posterior movement and rotation in pronation and supination. In this way I have succeeded in maintaining the sweeping movement of the wrist, both for a ring or a hook hand. Both can easily be adapted to take any of the ordinary working tools—*e.g.*, spade, fork, plough, wheelbarrow, etc. The screw hook allows the implement to be fixed into the ring, but it is interesting to observe that a man using the contrivance very rarely screws it up; he prefers to let the spade or fork play loosely in the ring. In this way there is less jolting and he can easily pull or push the implement, and he works like an ordinary man, who, taking a firm grip with his right hand, allows his left to slide up and down the handle.”

We believe that this contrivance should be made so that the distance from the top of the handle of the implement used to the nearest part of the ring should be at least 2 to 3 centimetres, so as not to hinder any possible movement.

2. M. BOUREAU'S HAND FOR VINE-DRESSING.—This instrument serves its purpose well; a complete description is given on pp. 80-83. The following descriptions are of devices over which we have spent much time, and which we think should be widely known.

3. JULLIEN'S TOOL-HOLDER.—This was designed by M. Jullien of Lyons for the use of the pupils at the École Sandar, and has been placed at our disposal by the inventor. We have experimented

largely with it, and consider it to be most useful. In the work of agricultural labourers an artificial hand is mostly employed in steadying the handle of the implement used, be it spade, rake, or hoe. At the same time the implement must be freely movable in all directions and planes. Boureau's hand answers these conditions fairly well, but when using it there is always one plane, which varies with the degree of rotation of the implement in use, in



FIG. 12.—OSCILLATING HOOK RING: LABOURER'S HAND, TYPE I.

which lateral movements cannot be carried out. In order to accomplish these lateral movements, the man has to rotate the implement with his sound hand. This additional movement is a serious disadvantage, as if the man wants to throw a clod in a certain direction he will have to alter the pose of his whole body, unless he has been careful enough before starting work to find the most suitable angle for screwing the tool-handle into the holder.

Jullien's tool-holder does away with this additional movement altogether; we will describe it shortly, together with a few modifications which we have adopted. It is made of a perforated steel tube 37 millimetres in diameter and 8 centimetres long; round it runs a steel band with a fixed screw, which passes through one of the perforations, and which is used for fixing the handle of the tool. At

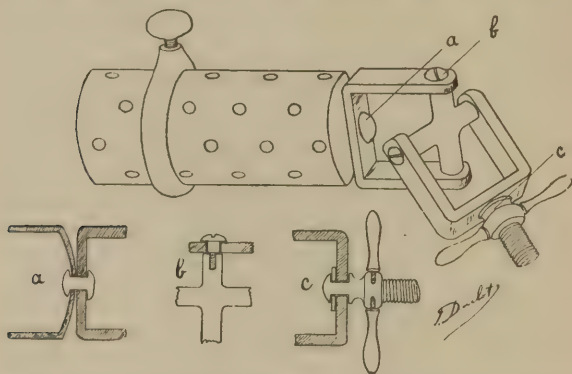


FIG. 13.—JULLIEN'S TOOL-HOLDER FOR AGRICULTURAL LABOURERS.

the other end, attached to the tube, is a universal joint, terminating in a screw which fixes the apparatus to a socket covering the stump.

4. We have already mentioned Spitzky's work; quite recently he published a book full of photographs showing his patients in various stages of re-education. These photographs show several men working on the land. We have examined these pictures most carefully to see how their implements

were fixed, and in most cases they seemed to be strapped on. We have tried this method on our temporary apparatus, which has already been described; it will be remembered that this apparatus carries two eyes on the wooden disc through which the straps pass. By this means the wounded man can get a secure grip of any implement, and at the same time control its movements; nevertheless, the implement is not so handy as when used in Jullien's holder, especially in side-to-side movements, besides not being adjusted to the best advantage. Altogether the strap method is not so good as Jullien's, but we have gained some useful hints from it; exceptionally it may, in individual cases, be better suited, as with it the most varied tools can be used, which cannot without difficulty be made to fit into a Jullien or a hook ring.

5. Aubert of Lyons, orthopædic instrument-maker, has patented another strap attachment device, which, although ingenious, does not give sufficient mobility, and so is not of much practical use.

C. Standardisation of the Hands.—We shall give some results farther on to show why we believe in giving men who have a useful stump—that is to say, one equal in length to one-third of their upper arm—certain hands, which we consider indispensable, as well as the usual ring and hook hands.

We provide—(1) a Jullien's tool-holder; (2) Boureau's swivel ring; (3) a pair of straps. The

total cost of these three additions does not equal the cost of a universal hand—Amar's, for instance.

For the final apparatus, of the type known as a working hand, to be of use to an agricultural labourer, there are several points to be specially noted in its construction. Three of these are very important:

1. For an upper arm amputation the shoulder strap must fit well and not be liable to slip; we believe the shoulder cap should be thicker at the edges than in the centre, so as to adapt itself to the bony prominences of the shoulder, especially the coracoid. This will prevent its slipping or turning to the front or back.

2. For a forearm amputation the lower piece must fit very well. The joint over the elbow must be in good alignment, and must lie on a line joining the tips of the internal and external condyles of the humerus; in this way, on flexing the joint, there will be no sagging posteriorly and the strain will be evenly distributed over the whole forearm, and no undue pressure will be present on the stump.

3. Lastly, and most important of all, there should be no space between the end of the stump and the socket of the apparatus, as this only increases the leverage and tires the man.

Jullien's holder and Boureau's ring both have a screw thread of 10/150, which will fit into any socket.

D. Results obtained.—Our results have been most encouraging. The main point is to succeed in

persuading the men, who are often most obstinate, that they can and must work, and that it is in their own interest to do so. As we have said before, an example is worth all the words in the world.



FIG. 14.—DIGGING : JULLIEN'S HOLDER IN USE.

Having managed to persuade the men to work, the results are always the same. A farm-labourer will relearn his work in a few days, helped by a temporary apparatus and later by a Jullien's tool-holder, together with his ring and hook. He will soon learn to like his work, and when his final

apparatus is ready he will go home, happy to be able to do his usual work once more. He is sent away able to use any farm implement, and a few words on each kind of work he does will perhaps not be out of place.



FIG. 15.—SHOVELLING: JULLIEN'S HOLDER IN USE.

DIFFERENT WORKING HANDS AND VARIOUS IMPLEMENTS.—1. A *spade* can easily be adapted to a Jullien, its handle being made rather long and straight. The other hand will guide all the movements by gripping the shaft, and in this way the man will have perfect freedom in all his movements,

at the same time having a fixed point of support. Most able-bodied workers hold their spades in the following way: The right hand grips the handle, while the left holds the shaft. A man who has lost his left hand has to accustom himself to a



FIG. 16.—HOEING: JULLIEN'S HOLDER IN USE.

reversed position, which he does without any difficulty at all.

The strap attachment can be used for this work, but in this case the spade must have a **T**-shaped handle. Of the two methods, Jullien's gives the better control and greater comfort.

2. *Pitchfork, Shovel, and Pickaxe* (Figs. 14, 15, and 16).—In using these implements, Jullien's apparatus gives the best results, as freedom of movement is in all cases most essential. We have seen a man with a forearm amputation loading



FIG. 17.—MOWING: JULLIEN'S HOLDER IN USE.

hay the first day he had been fitted with his appliance, and doing it just as quickly as his comrades who had the use of both hands.

3. *Scythe* (Fig. 17).—If there is one thing a man who has had a hand amputated believes, it is that he will never be able to use a scythe again. But

we have had the most excellent results in re-educating the wounded to this work.

(a) *In Upper Arm Amputations*.—As in this case the fixed point will be too high for comfort, it is necessary to fit a shaft 8 to 10 centimetres long on to the stump-covering, and to fix a Jullien on to the lower end of the shaft; into this is fixed the handle of the scythe. Men with their right hands off will have to use a left-handed scythe, but those without their left hands can use an ordinary one.

(b) *In Forearm Amputations* the operation is even easier. We used to watch two men, each with his right hand off, doing it in the following way: They used ordinary scythes; one man had a ring and the other a hook, and in each case they used their artificial hands to hold the middle of the shaft of the scythe, and both did their work perfectly. In this case the stump becomes the working arm, which was not so in the other cases we have described.

(c) Following a suggestion by M. Jullien, we have devised a special holder for the scythe whilst it is being sharpened. This holder fits on to the blade, which is steadied by a wooden prop. It is an elementary thing, but it is strong and serves its purpose.

4. *Rake and Hoe*.—In this case either a Jullien or straps are equally useful, but often a ring hand does to steady the handle.

5. *Wheelbarrow and Watering-Can*.—According to the skill of the individual and the weight to be

lifted, any one of the following can be used: Straps, Boureau's ring, a stretcher-bearer's shoulder straps, or even a simple ring and hook.

Only those watering-cans should be used which have a handle right on top, as these are the easiest to lift without upsetting.

6. *Plough*.—A man can easily drive a plough with a Jullien if he first removes the fixed screw on the tool-holder, so that he can withdraw his arm at once from the plough in case of trouble with his horses. An upper arm amputation needs a shaft with a shock absorber to fix on to the Jullien.

We must, in conclusion, say a few words about amputations through the shoulder-joint and about useless stumps.

These men can still be re-educated, as with a little skill they can learn to work with only one arm. Their implements must be fitted with **T**-shaped handles. A man using a spade, for instance, forces it into the ground, and then, bending his knee, uses it for levering up the spade; this enables him to raise the point of the spade, and with a little practice he can throw the earth some distance. Work is, of course, slow under these conditions, and re-education takes longer, but the results are quite satisfactory. We have tried fixing the middle of the shaft of the spade to the man's shoulder by means of a sling, so that by straightening himself he could raise the spade, but in most cases this method did not succeed.

Summary.—1. Every upper arm stump can and should be used if it is as long as one-third of the original upper arm.

2. Surgeons must induce the men to work on the land, and must see that they are fitted with suitable apparatus.

3. Every stump must be prepared for use by massage, and any arthritis treated.

4. On his arrival, the patient must be supplied with a temporary appliance, as it is during the time that he is awaiting his final apparatus that we have the best chance of re-educating him.

5. He should be supplied with suitable tools; as well as the routine ring and hook hand, we suggest—Boureau's swivel ring, Jullien's tool-holder, straps.

6. We believe it to be in the best interests of the maimed to standardise some of these appliances, and we would especially recommend that of M. Jullien.

CHAPTER VII

**AGRICULTURAL RE-EDUCATION OF THE
MAIMED****I.—Re-adaptation of Men who have lost an Arm to
Agricultural Work.**

THE dearth of agricultural labourers will be even greater after the war than it was before. Seventy per cent. of our army is made up of this type of man, and consequently the wounded will be roughly in the same proportion. No mention has been made of the vast numbers with some injury or other to their hands and fingers. Every effort should be made to set these men up again in their work on the land, as otherwise there will be no one left to cultivate it. Some people, even yet, do not seem to have grasped this important point. The general tendency of the various soldier's help societies is still towards teaching the wounded some profession, and completely ignoring their pre-war work. One must admit, however, the lure of finding a man an easy position, where he can live comfortably with the help of his pension.

I remember once seeing a man who had lost one of his eyes learning mathematics, in order to pass

an examination for a clerkship; he told me that before the war he used to be an agricultural labourer ! Why was anyone so misguided as not to tell him that his duty was to return to the land, even though he only had one eye ? Why not set him up at his old work in his own village ? If one considers for a moment, one is bound to admit that work on the land offers the wounded the best chance of leading a happy and easy life.

Agriculture has such a large number of branches, each of which calls for its specialists. Village life is undoubtedly easier for an invalid than town life, as the pension, of seven or eight hundred francs, goes much farther in a village; and besides, everyone knows one another, and so is more ready to offer a helping hand.

I have satisfied myself that a man with an artificial arm can do better work on the land than anywhere else, as in agriculture all movements are much less complicated; for this reason I have devoted most of my time to fitting my patients for work on the land.

M. Bourrillon has shown that in many cases this work can be done without an artificial aid of any kind, always provided that the man has a good stump; nevertheless, some apparatus is needed for special work, and each kind of work requires a different "working hand." In some cases all that is required is some slight adaptation of the implement in general use to the wounded man's needs.

The number of mutilated men at work in the fields will soon be so great that the makers of the various agricultural implements will be bound to make some modifications in their standard patterns, whenever necessary, for individual cases.

Occasionally the only alteration necessary will be a change in position and shape of a lever, to enable the wounded man to use a mowing machine, plough, or mechanical rake.

I make no pretence at having solved so vast a problem as that of these various adaptations, but I hope that these few words will encourage people with an inventive turn of mind to tackle this question, which means so much to our wounded.

Essential Requirements of an Artificial Arm for Agricultural Work.—The artificial arm can only act as a help to the sound arm; it is not fair to ask it to do heavy or skilled work; it must act in the same way as we use our left hands to help our right. A man who has lost his right arm soon learns to make his left arm do its work; this re-education starts the first day that the wounded man is convalescent. He soon learns to use his soup-spoon in his left hand, and in a month or so he will be writing perfectly.

As this substitution is done so easily in everyday actions, there is no reason why it should not be as easily accomplished at the man's work. Indeed, it is much harder to write with the left hand than to use a hammer with it.

The first conclusion we can draw, then, is that for a man who has had an arm amputated all we have to do is to supply an artificial help for his remaining arm.

The second conclusion is that the left arm only requires to be trained.

Each kind of work must be studied separately by watching an able-bodied workman at his task; careful note should be made of every movement, both of the right and left arms. Having thoroughly dissected the man's attitudes, one gets a series of fundamental movements which the left arm must accomplish. In some cases these movements are very varied, whilst in others they are quite simple, the same movement and attitude being continually repeated.

It is interesting to note that, in general, the left arm makes very simple movements, working mostly in the same plane and direction. By analysing these different movements, we have been able to supply artificial aids which soon enable a one-armed man to work at a good speed.

In conclusion, we may state that the apparatus required to take the place of an arm or hand bears, as often as not, no resemblance to the natural organ, but is a special adaptation for the work to be done, and is usually quite simple and cheap to manufacture. This is the case in a number of professions—*e.g.*, gardener, vine-grower, labourer, printer, postman, and even mechanic. In all these

some simple apparatus is more useful than the most ingenious mechanical arm.

On the Relative Value of Men with Arm Amputations at Different Levels.—Leaving aside the personal factors of skill, intelligence, and previous knowledge, the value of each man depends absolutely on the length of his stump. Any artificial apparatus is dependent for its efficiency on the amount of shoulder leverage present; the greater the leverage, the better the final result will be, and *vice versa*, until a certain stage is reached, when the stump is so short that the artificial arm merely hangs uselessly by the side. Up till now the anterior fold of the axilla has been used for measurement purposes, but personally I consider a fixed bony point is more reliable.

The average measurement of an arm from the top of the head of the humerus (exactly over the tip of the acromium) to the internal epicondyle is about 30 centimetres. A short way above the centre of the bone (2 centimetres) is the deltoid insertion. This muscle is responsible for backward, forward, and abduction movements, and so in every case in which the amputation has been carried out below the deltoid tubercle there will be complete control over any artificial apparatus, and the man can be made into a useful worker.

On the other hand, if the amputation has been carried out above the deltoid tubercle, then the arm will not be nearly so useful, as the main deltoid

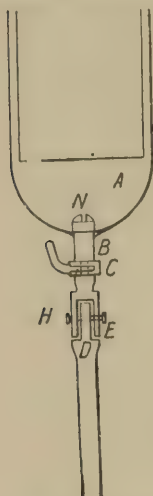
mass will only have scar-tissue to pull against. In this case the man will have little control over his artificial arm, and will be incapable of hard physical work, being practically in the same state as a man with an amputation through the shoulder-joint.

To an agricultural labourer a stump of this kind is more useful than to a city or industrial worker, as in every large farm there is always something a one-armed man can do, and one can assert definitely that agriculture is the best thing such a man can devote himself to. With a 13 centimetre stump digging and hoeing are possible; with an amputation through the elbow-joint nearly every field implement or machine can be successfully used.

The Agricultural Arm.—The utility of a “working hand” depends to a large extent on the support it receives from the artificial arm. For a worker on the land this arm must answer certain definite requirements: it must be strong, very simple, easy to repair, and able to withstand jolts and jars. Imagine the state of a man, right away in the country, with an arm that is always getting out of order! It must be capable of being repaired by the local locksmith or bicycle repairer. It must be cheap and its parts interchangeable. On Sundays and holidays the working hand must be easily changed for a model of the natural hand, to improve the man’s appearance.

I will now describe the type of arm I have found most suited for an agricultural workman.

Sheath for the Stump (Fig. 18).—This is made of a hemispherical cap *A*, into which are inserted two metal side-pieces, covered with leather. Into the



top of the cap is fixed a steel pin *B*, which can be rotated on its axis or fixed by a metal band *C*, in the same way as one locks the handle-bars of a bicycle. Kept in position by a screw-nut *N*, it rotates easily and freely, and can be used for any kind of work.

Elbow Articulation (Fig. 18).—The lower end of the steel shaft splits into two pieces *E*, between which fits a piece *D*, which is the upper end of the forearm shaft; the whole is jointed by a pin *H*. This gives a free but firm joint.

FIG. 18.—SHEATH
FOR STUMP AND
ELBOW FITTING
FOR AN AGRICULTURAL ARM.

M. Bouissieren of Paris has devised an even simpler arrangement. The joint is made by two circular plates rotating on an axis *H* (Fig. 19). The joint can be locked at any desired angle by a catch placed on the forearm substitute. This catch *K* (Figs. 19 and 20) is formed by a shaft which runs along the forearm, ending at the wrist in a rounded projection, and fitting at the elbow-joint into one of three slots on the humeral piece. This shaft is fixed to the distal piece *T* by two bands *MM*.

When the catch is open the arm is free and the joint is flail; when fixed into the top slot the arm is at 45 degrees; into the next one the arm is half flexed; into the lowest one it is in full extension. These three positions are sufficient for agricultural

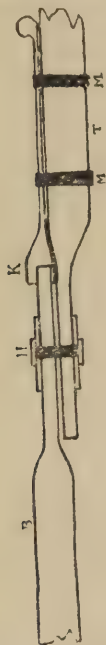


FIG. 19.—ELBOW
ARTICULATION.

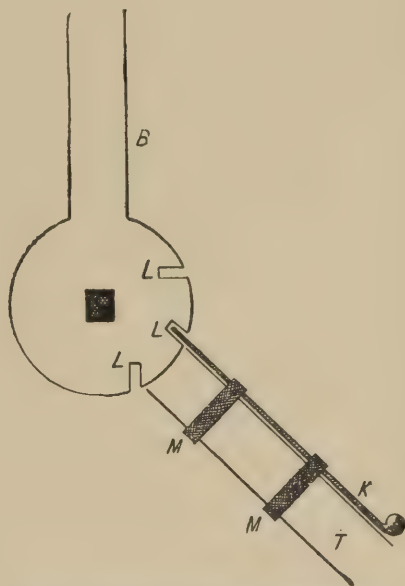


FIG. 20.—ELBOW ARTICULATION FOR
AN AGRICULTURAL ARM.

work; no catch is any good which does not allow perfect freedom to the elbow-joint when required. I have found out that in certain kinds of work—*e.g.*, digging—the freer the joint is, the less tired the man gets. I have made a study of most of the

elbow-joints. Many are too complicated and become unhinged with the least strain, being made with springs, which soon get out of order. A model was shown before the Orthopædic Commission in which there was a pressure-screw operating under the axis of articulation of the elbow-joint and fixing it by friction. It was fragile and difficult to work, and did not appear to me to answer its purpose.

The bolt which I suggest has no spring, can easily be mended or taken to pieces, and is made of a single metal shaft which can be replaced with ease.

Mode of Attachment of the Arm.—If the stump is long enough, three straps attached to the shoulder piece will be sufficient; this is the classical method, and it has the advantage of being easily repaired if necessary.

If the stump is only just the 13 centimetres long required for a useful arm, the best fitting is a circular leather sheath reaching as far as the centre of the clavicle in front and the spine of scapula behind. If necessary, the whole can be attached by a large thoracic support in the shape of a waistcoat.

The *forearm* is made of a steel shaft, which must be shorter than the natural forearm, as Gripouilleau stated some time ago, so that the distance between the hand and elbow should not be too great. Compared with the natural arm, the artificial one should be at least 25 per cent. shorter. Its shape should be that of an ellipse, presenting its greatest diameter

in the antero-posterior direction, where the greatest strain falls.

The arm ends in a cylindrical socket such as I have already described, into which can be fitted the various types of hand.

I shall here omit the interesting question of the different types of hands and the work they are suited for.

A supple wrist-joint is by no means only fitted for the lighter forms of work, as it is extremely convenient in many types of heavy labour. I fitted a hefty miner with a movable wrist, and he found he could do his work well with it. I have seen men doing the heaviest forms of work, such as digging up difficult ground and throwing the earth into a barrow, who were fitted with movable wrists, which answered their purpose admirably and made the work easier. I believe that the more movable and better jointed an artificial arm is, the less tired the man gets at his work.

The heavy work just mentioned is done much more easily when the arm is free instead of being locked at the elbow in full or half flexion; allowance should also be made for some degree of rotation. Suppleness and mobility are essential for heavy work.

The arm I have just described is fairly cheap. It should not cost more than 100 francs in its simplest form, or 150 with a jointed wrist. It is much lighter than the older models, only weighing between 700 and 750 grammes.

II.—Adaptation of the Patient to the Implement, and of the Implement to the Patient.

The two problems, that of enabling a patient to use an agricultural implement and that of suiting the implement to the patient's use, must be considered together. Implement-makers and artificial arm makers must be ready to meet each other half-way, and together to devise something suitable.

ARM IMPLEMENTS.

(a) **Agricultural Implements.**—The principal ones in use are—spade, hoe, pick, rake, and mattock. In handling these, the artificial arm has to act as a guide to the good arm, since the latter must grip the shaft of the implement.



FIG. 21.

- 1, T-handle; 2 and 3, Grips used in England and Belgium;
4, American grip; 5, French grip for hoes, small spades,
picks, rakes, and mattocks.

The shape of the tool does not interest us much, as it is only the handle that we are concerned with. Most models are shaped on the same principle, but

the one that answers our purpose best is the French shape, T-handles being too difficult to control. As for the American handle, a few strokes with a saw will convert it to a shape suitable for our purpose. The artificial hand designed to hold these handles must be strong, simple, and, above all, allow free movements backward and forward and from side to side.

For example, the ring hand, provided by the State, does not give flexion or rotation on its own axis; to compensate for this, the worker has to make additional movements, which are tiring, and which hinder him in his work. Again, there should be a lock under the man's control; a certain number of the advertised arms answer these specifications. I would like to mention especially Gripouilleau's ring, Jullien's tool-holder, M. Nové Josserand's simple leather forearm strap, and the grips of MM. Amar, Estor, and Lumière.

In 1915 I suggested an oscillating ring hook before the Surgical Society. Ever since then, although I have given every new arm a trial, I have remained true to my original idea. Men are using it all over the country. Among its advantages are—no springs; it gives all wrist movements; it can be used with any type of handle; it can be used for any agricultural work; it allows a man to push a barrow, work a pump-handle, or pick up a pail or bucket. In fact, with a ring and hook a man can do practically anything.

For some time now I have added a catch on the portion nearest the wrist, to fix the ring and prevent backward and forward movements if so desired. With a hook a man can pick up a wheelbarrow handle in an instant—compare this with the time taken when using a screw-in handle! The hook can be screwed up tight into the ring, and will in this way give a firm grip on any implement passed through the ring; but, as mentioned previously, the workman very rarely uses this screw-in attachment, as in this way he gets less jolts and can work in the same way as an able-bodied man, who grips the handle firmly in one hand, while he allows the other to play loosely up and down the shaft. Lateral movement is most important, as it allows the man to empty his spade into a barrow, or build up a manure-heap, both of which are essential tasks for an agricultural labourer.

(b) **Harvest Implements.**—What I have just said is equally applicable to a scythe. The good hand controls it, whilst a hook on the artificial arm steadies it. This hook must be bigger than either the one supplied by the State or the one on my hand. In using a scythe, the sound hand grips the centre of the shaft, whilst the hook-ring controls the handle end. With the ring as a fixed point, the strokes can be well carried out; this is entirely due to the ring's good swivel movement.

(c) **Pruning Implements for Vines, Hedges, and Fruit-Trees.**—Different as these types of work may

at first appear, they all have three motions in common—

- (1) Separating the branches.
- (2) Gripping them.
- (3) Steadying them.

The left hand has to do this, while the right works the cutter. One would imagine that none of the



FIG. 22.—PRUNER'S HAND.

artificial hands could do this, as the sound hand, instead of doing the cutting, would continually be having to screw and unscrew the grip. An instrument is required which will grip the branches automatically; an ordinary hook can pull the branch down, but cannot steady it. To overcome this I designed the "pruner's hand."

I use a curved spring which opens and grips the

branch, the spring being operated by simple pressure; all the man has to do is to push the hand against the branch, when the spring opens and grips the branch for the other hand to cut. This was not sufficient, however, as some branches required to be pulled and others to be pushed. Only a hook could do both these movements; so I borrowed one of M. Gripovilleau's hooks which he mounts on a narrow shaft. With this the man can engage the branch in the hook and fix it absolutely by a movement of the lever. By shortening the hook-shaft and putting on a piece for the spring to work against, I left a space which is useful for planting vine supports. The end of the support is put in this space, and by rocking the arm a little the prop becomes wedged in and is steadied, while the sound arm hammers it into the ground.

In the winter these vine-growers prepare grafts, and in this operation the left hand plays a most important part. To enable my artificial hand to do this, I added a curved lever on to the spring, which is kept down by another spring. The lever projects on to the forearm, so that it can be worked by pressure on the knee when the man is seated, or by pressure on his chest when he is standing up.

The man places his graft under the spring, which grips it firmly enough for him to cut. This lever allows a gardener to prepare slips. The spring at the base can easily be taken down, and, according to the work to be done, can be made easy or stiff.

For instance, in working with slips, a gentle spring will not injure the flower-stalks, while in dealing with shrubs a fairly powerful spring is necessary.

Lastly, one workman indicated unconsciously an improvement I could make on my original model. Placing a twig in the grip, he twisted his hand, making it revolve through 90 degrees, and in this way brought the other end of the twig towards the pruning-knife. This showed me that this particular working hand should be able to revolve on its axis in the same way as other hands, such as the hook and ring hand. I have put this into practice by putting a male and female fitting on to the hand, which can be screwed up tight.

(d) Agricultural Implements drawn by Horses.—When a one-armed man has to drive a horse-plough or a motor tractor, it becomes essential that some means be adopted for controlling either the horse or the motor without definitely attaching the man to either, as is the case with a screw-in apparatus. It is not safe to fix a man to his team or motor, as he may lose control and fall and be dragged if he cannot get his arm clear. This is an important point which should always be considered when teaching these men motor or horse driving. All gripping appliances which work on the screw-in principle are useless for this kind of work.

One could, of course, fit this type of arm with an automatic release, but anyone who knows how little care the men take of their arm would certainly reject

this contrivance as unlikely to work at the critical time.

1. *Ploughs*.—These are the most important of all agricultural implements, and once we have enabled a man to drive one, we can feel that we have done something really useful.

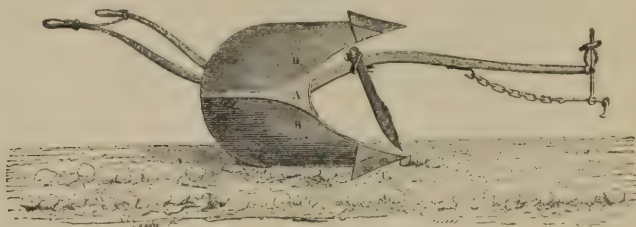


FIG. 23.—A FRENCH PLOUGH.

There are many patterns of ploughs, but only two essentially different types, swing-ploughs and ploughs with a fore-carriage. To drive the former type, the man leans his weight on the handles to raise the plough-share to turn the plough, and at other times he simply guides the plough.

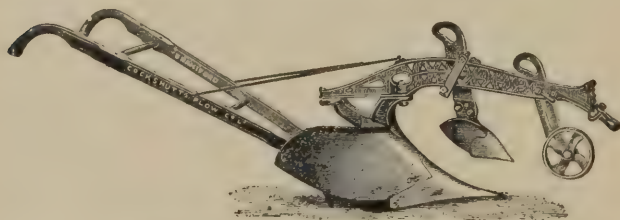


FIG. 24.—CANADIAN PLOUGH WITH MOULDED STEEL BEAM.

It is obvious that a disabled man can only use a plough which is easy to work. Every day the

tendency is to make ploughing easier, and independent of the ploughman's skill, by previous adjustment of the depth of the furrow. The handles of the plough are usually made of two horizontal pieces 3 to 4 centimetres in diameter.

Up till now I have found that a movable ring is quite suitable as a hand without any screw attachment, as its diameter of $5\frac{1}{2}$ centimetres allows of a quick release in case the man slips or the team bolts. The hook must be unscrewed to its limit, so that it does not take up any room in the ring. Owing to its freedom of movement, many of the jolts incidental to ploughing pass unnoticed, and there are many men who are using it in comfort. The handles of the French ploughs are quite suitable for the hooking, but those of the Canadian plough are too much curved, and so are not quite safe, as they might jamb in the ring at the critical time.

Instead of the usual plan adopted by the makers of delivering a plough without considering the disability of the man who is going to use it, it would be advisable for the plough to be made according to each man's individual requirements. Another plan is to fit the plough with adjustable handles, as shown in Fig. 25.

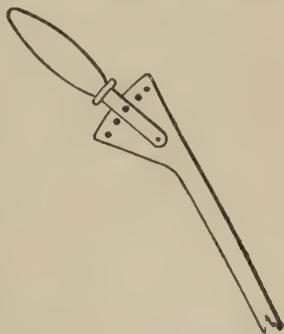


FIG. 25.—ADJUSTABLE HANDLE.

The ploughs fitted with a fore-carriage to keep the furrow at a constant depth only require to be guided, and for this purpose a single handle is sufficient.

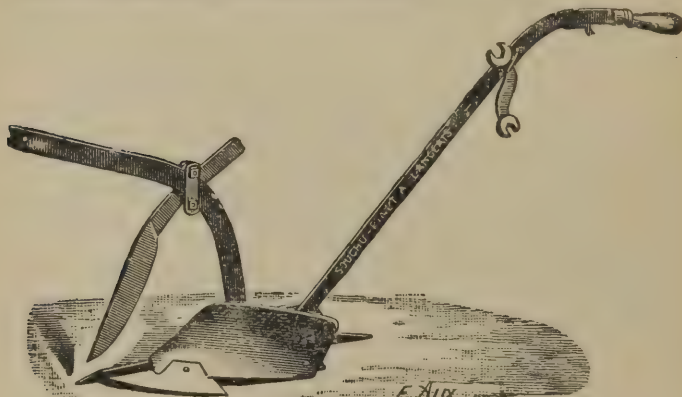


FIG. 26.—SINGLE-HANDED ADJUSTABLE PLOUGH.

The model shown in Fig. 26 is most suitable for a one-armed man, as he can use his artificial hand to drive the team and his good hand to guide the plough. The Flemish skate plough and the two-shared plough are both fitted with a single handle (Figs. 27 and 28).



FIG. 27.—PLOUGH WITH SKATE SUPPORT.

A certain number of other agricultural implements are worked by handles which are suitable for the

ring hand—*e.g.*, moulding plough, harrow, horse-rakes, etc. There is also a type of plough which is worked by a lever, but this is not so easy to manipulate as a handle.



FIG. 28.—A VINEYARD PLOUGH FITTED WITH A HOOK AGAINST WHICH THE PLOUGHMAN LEANS.

2. *Team Driving*.—This is important, as although a man can hold the reins in his sound hand, he cannot very well drive the team straight with a one-handed control; to get over this difficulty, the artificial hand must be made to help. At once we are met with the difficulty of the danger of tying the man to his team! Here is a device I would suggest to overcome this difficulty. It is made of three horizontal pieces fixed at right angles to a vertical piece. The reins are passed over the end bar, side by side if they are round, or one on top of

the other if they are flat; they are then passed under the next bar, and, lastly, over the third bar. In this way, if the man lifts his arm the angle made by the

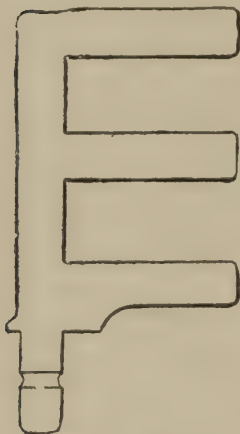


FIG. 29.—REIN-HOLDER.

rein is lessened and the man gets a good grip; if, on the other hand, he lowers his arm, the reins are no longer gripped and slip out sideways. This model is suited for leather reins, and can be adapted for cord reins by making the bars thicker and by approximating them.

To stop his team, the man simply raises his arm and pulls, or uses his good hand to pull with; to turn the team, he pulls the corresponding rein with his good hand. If any accident

occurs, the artificial hand is pulled into a horizontal position and the reins automatically are released.

3. *Tractor Driving*.—All motors are controlled by hand-levers and foot-pedals. In one or two types the driver can walk alongside the machine, but even then he must use levers. We will leave the pedals out of the question here, as we are only dealing with one-armed men. All the levers are of the same type, a movable shaft with a round handle, and fitted to the neck of the shaft a hand-grip control. The lever is operated by two movements—(1) gripping the control, (2) pulling or pushing the lever when it is

free. No artificial hand can carry out these two movements. With the help of M. Bouisseren, of Paris, I have made the following modification: the lever itself has been left unaltered, but the grip has been modified. Instead of a squeeze grip, I have

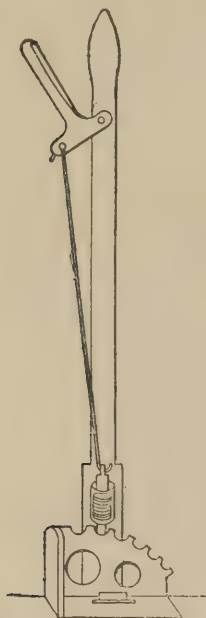


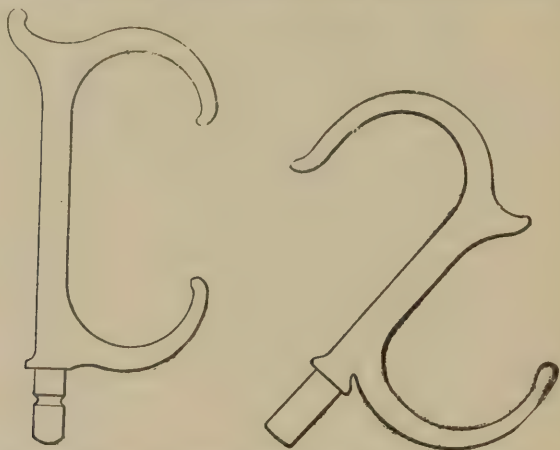
FIG. 30.—AGRICULTURAL MACHINE LEVER AND CONTROL.



FIG. 31.—LEVER ADAPTED FOR AN ARTIFICIAL ARM.

converted it into a pressure catch. By pressing down a bar, the control lock is released and the clutch can be slipped or the brake applied. This is an easy movement, done by the weight of the body. I have constructed a **C** hook for this purpose in order to engage the bar.

All the man has to do is to place his **C** hook over the bar and press down, thus releasing the lever. Without moving his hand, he can advance or retard the lever, and when it is in the desired position he raises his hand and the lever is locked at once. This fitting suits nearly all machines, but in some motors the levers do not act quite in this way, and to over-



FIGS. 32 AND 33.—AGRICULTURAL MACHINE AND MOTOR DRIVER'S HAND.

come this I have designed a double **C** hook (Fig. 33). This double **C** comes in usefully for many agricultural tasks.

If one watches a farm-hand at work, one will see that his left hand is mostly used in pulling or pushing movements. This double **C** can do both these movements, while the sound hand can do the more delicate work. The double **C** can lift bundles of wood or

hay, drag a barrow, push a hand-cart, carry baskets and milk-pails; can bring the horses their water, handle a fork or spade, and lift harness.

When the wounded man goes to work in the fields he can take his ring-hook; when he goes pruning, his pruning-hand; when he drives, his driving-hand; when he uses the mowing-machine, his double **C** hand; when he goes to repair some machinery, his mechanic's hand. With these five fittings he becomes a complete workman, and with a little practice he is soon as useful as his neighbour who has both his natural hands. It naturally takes some time to gain this result, as the first day he is given his outfit he is as clumsy as a man on a bicycle for the first time. This is where the centres for re-education have their chance; it is up to them to teach the man well, and to see that he has a completely suitable outfit.

4. *Agricultural Machines which can be driven by Modified Levers.*—By modifying their levers, the following machines can be driven by a one-armed man:

Multiple ploughs fitted with only one handle.

Ordinary ploughs for level ground.

Canadian harrows, manure-distributers, seed-sowers, potato-planters, haymaking machines, mechanical reapers, horse-rakes, and machines for uprooting, etc.

I have not mentioned combined reaping and binding machines, as their levers are too numerous and complicated for a one-armed man to manage.

Conclusions.

Any agricultural labourer who has lost an arm can be retrained to work in the fields, and can in this way earn a better living than in a sedentary occupation.

Artificial aids may be of two kinds:

- (1) Alteration of agricultural machine levers.
- (2) A set of five working hands, which are both cheap and strong, and by means of which a man can do agricultural work of any description.

CHAPTER VIII

**AGRICULTURAL SCHOOL FOR THE DISABLED
AT ONDES**

IN speaking of men disabled in the war, one is inclined to consider only those who have lost a limb; but there are thousands who, although they have both their legs and arms, have had their nerves utterly ruined. Take, for example, the case of a man who has no control over one of his arms; he might say something like this:

“What can I do now I have this disability? I used to work in the fields, but now I cannot manage a plough or tend my vines—I am no good for any work.”

“But you must live, and your pension is insufficient.”

“Well, doctor, I will ask my Member to find me an easy job.”

The war and its accompaniments, trenches, wounds, and hospital, has completely unnerved the man and rendered him useless.

“The body wound is made infinitely worse by the man’s loss of will-power, and it is our task to infuse some energy into him; this is where professional re-

education comes in." These were the words used by Dr. Boureau at Tours when introducing his system of mechano-therapy before the French Association for the Advancement of Science.

The wounded are to be found lounging about in hundreds in the various massage and electrical departments of the hospitals, while their treatment requires, perhaps, one hour daily; it is from these men that the re-educational schools get their pupils.

Before the war, three-quarters of these men used to work on the land. They appear to suffer not only from the loss of an arm or leg, but also from a lack of brain power. By this I mean that it is rare to find a man who can grasp any new ideas or improve in any way on what his father taught him—in fact, who can make farming a profitable undertaking.

One can get as many patients as one wants from the various hospitals and try to benefit them morally and materially: morally because it keeps them away from public-houses and street corners, and materially because the younger ones are taught a trade, which the older and more experienced men can teach them.

The State benefits by this education, as the men do useful work instead of gymnastics and can help to earn their living.



FIG. 34.—PLOUGHING BY DISABLED MEN.



FIG. 35.—MOUNTING AND REPAIRING AGRICULTURAL MACHINES BY DISABLED MEN.

The Ondes and Grenade Schools.

The Ondes school is a centre for new ideas and methods. The director, M. Duchein, has an honorary teaching staff as well as his administrative staff. This is a plan that should be followed everywhere.

The local school building was converted into a hospital school for the wounded. Batches of 100 wounded come for four months' instruction. A house, a few kilometres away, has been presented for the use of the "farm mechanics"; this is as it should be, as for the past ten years we have been trying to impress the farmers with the fact that it is better for everyone who is connected with agriculture that shoeing-smiths, wheelwrights, mechanics, and harness-makers should flourish. At first sight this does not seem important, nor does it if one listens to men travelling in farm machinery, nor if one looks at the catalogues; but it is a fact, nevertheless, and it is really essential that a farmer should have a repairing shop, in case of the breakdown of one of his machines at a critical time, such as the harvest. Now that tractors and motors to carry away the harvest are in general use, the farmer must be able to drive and repair them.

Work at the forge, barrel and basket making, are mostly given to men who have lost their legs. As the school can pick its pupils, only those are chosen who seem suitable and unlikely to retard the

work of the others; one aims at getting young men who can be trained to be head men or farmers.

The Classes.—In spite of only a limited teaching staff, the lectures cover general farming, rural economy, vine-growing, chemistry, agricultural technique (wine and milk production), horticulture, zoology, surveying, and account-keeping. In all these lectures definitions and historical accounts are omitted, and the lecturer keeps strictly to the point. The results are quite marvellous, and the audience is most attentive.

M. Duchein asks: "Why is it that our young farmers must be incapacitated before they will come and listen to what they should be taught about their profession? They would never do it in peacetime."

A medical report says: "The patient soon picks up wonderfully, assisted by his instinctive desire to work on the land. His brain, which at first was stupid and sluggish, soon grasps these new ideas, and, waking up, the patient becomes enthusiastic and can be seen to alter in character. It is an oft-repeated joy to the teachers to find under a rugged exterior a brain of the highest intelligence. They take notes—true, at first they are bad ones, but they soon improve, and often ask for additional explanations of what they do not quite understand."

Their physical re-education is just as quick as their mental re-education. The need for note-taking encourages them to use their left hands if

their right hands have been amputated or injured. The necessity for using the various implements sharpens their ingenuity in making use of their weakened arms or even their stumps. Our reports indicate that men fitted with artificial limbs do not give such good results as the others.

With the greater number of field implements now fitted with a driver's seat, the personal strength and endurance of the workers is diminished. Seated on a plough or a mowing-machine, the injured man can do just as much work as his able-bodied neighbour.

The money question is irrelevant, as it is the whole country and not the Government which gets the benefits from the school, directly or indirectly. The school can find positions for its pupils when they are discharged from the service. Some most touching letters have been received from old pupils, saying how much their social standing has been improved. This state of thing is worth more than any diploma they receive on leaving, and pays one back more than any thanks from any Commission appointed to inquire into the conditions obtaining at the school.

[CHAPTER IX

**SILK-PRODUCING IN ALGERIA FOR THE
WOUNDED**

BY A. DE MAZIÈRES

UP to the present time, silk-worm culture has been neglected in Algeria, although it is a most profitable occupation, which only requires a small outlay. In Algeria the climatic conditions are wellnigh perfect for this work. The probable reason for this neglect is that the men who have devoted themselves to silk-producing have not been able to make it pay sufficiently well, owing to their ignorance of the latest methods and the market values. In a country where most of the estates are of large size no branch of agriculture should be neglected, especially silk-worm farming, as the work connected with it is very light; and while the profits should be high, the expenses are small. Besides, it does not interfere in any way with doing other necessary work on the farm; care rather than hard work is what is required, and disabled men, women, and children can do the work satisfactorily—in fact, it appears to be an ideal occupation for the maimed soldier, widows, and orphans.

Algeria should, with its most suitable climate for mulberry-trees and silk-worms, at this critical time, take her place amongst other silk-producing countries in order to make up for the shortage of silk. The first silk-growing efforts were made in Algeria in 1841, under the direction of M. Hardy and a few colonists living there; these attempts showed the complete suitability of the Algerian climate. The silks grown at the central nursery were at once classed amongst the finest in the world.

In 1850 silk-worm farming began to be neglected in France, and, indeed, all over Europe, as diseases, until then unknown, attacked the precious caterpillars and paralysed the efforts of the farmers. Algiers escaped this plague for some time and profited thereby, but eventually the disease was spread there by the importation of contaminated cocoons. Since Pasteur made his wonderful researches into the cause and prevention of silk-worm disease, this industry has taken on a new lease of life.

Small silk-worm farms are advisable in Algiers, as then the initial outlay is small and the care and labour necessary are reduced to a minimum. The main point to observe is that the most healthy conditions must obtain during the worm's incubation period, and this is difficult to insure on a large scale without considerable expense. Silk-worm farming only really becomes profitable when the incubators are not too large and the number of worms not too great. There is an old Cérennes proverb which says,

in effect, that the fewer the number of worms kept together, the more silk will be produced. One couple can produce an ounce of eggs without much expense; one ounce for producing cocoons requires the following expenditure:

1 pound of cocoons	..	..	..	1 fr. 50
Incubation expenses	..	..	..	1 fr. 50
Paper for spreading	..	..	..	6 frs.
Heating, lighting, etc.	..	..	..	8 frs.
				<hr/>
				17 frs.

By improved methods one can obtain 100 to 120 pounds of cocoons from one ounce of eggs. Allowing 3 francs for two pounds of cocoons, the takings average 150 to 180 francs, and the profit 150 minus 17=133 francs, or 180 minus 17=163 francs. There is an increasing demand for silk all over the world.

Algiers is really a branch of the silk industries of Florence and Turkey. In France, Greece, the Caucasus, Japan, Turkey, and Persia, the Governments have endowed the trade in order to encourage the production of silk, as the demand is everywhere much greater than the supply. Private enterprise is good, but Government encouragement, as in 1841-1851, is necessary.

The industry should be organised by the Government in the following ways:

1. By giving information as to the best way of growing mulberry-trees and any improved methods of keeping the worms.

2. By distributing free of charge, or at a trifling

cost, carefully chosen eggs, especially to individuals or families who have suffered in the war.

3. By buying back the cocoons at a profit to the seller, so as to prevent agents from buying them at an absurdly low cost, in order to try to corner the market.

4. By creating a model mulberry-tree farm and a nursery where the latest methods are taught.

5. By establishing silk-worm farms near the hospitals for the instruction of the wounded.

6. By teaching some of the wounded the art of silk-worm culture.

7. By obliging the farmers to stamp out the silk-worm disease.

8. By supervising the egg-selling shops.

9. By distributing pamphlets in French, Arabic, and Kabyle, with instructions as to the best methods available.

CHAPTER X

BASKET-MAKING FOR THE WOUNDED

BY EUGÈNE LEROUX

At the Fayl Billot School the wounded are separated into two groups—those who can see and those who



FIG. 36.—BASKETS MADE BY THE MAINED.

Note.—A few weeks previous to taking the photograph not one of these men had ever attempted to make a basket.

cannot. Men who have the use of their eyes take three months to learn, after which they receive a

certificate; those who wish to perfect themselves in the art of basket-making can remain four, five, or

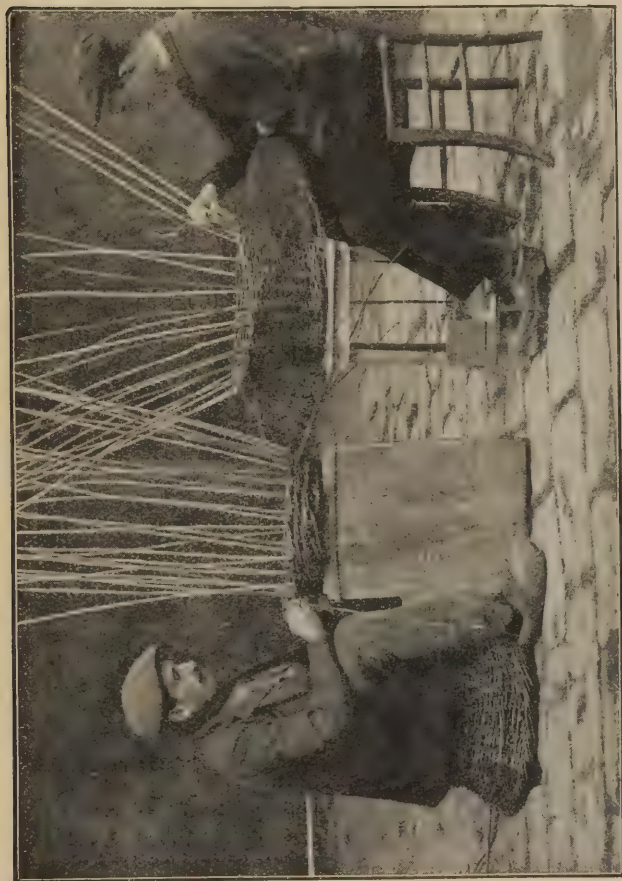


FIG. 37.—A ONE-ARMED MAN AND A ONE-LEGGED MAN MAKING FARM BASKETS.

Note.—The one-armed man is using a device, invented by M. Cunin, for keeping his basket steady with his foot.

even six months if they can obtain the authorities' consent. Blind men stay at least six months.

The school can accommodate twenty men who can see and twelve who cannot. Each man must have a discharge certificate before being admitted. All the men are boarded and fed in the school building, and taught the kind of basket-work they prefer, either large or small baskets or luxury work. After their training the school looks after their welfare; either a situation is found for them or they are sent away to work at home. In the latter case the school sees to it that the baskets they make are bought up.

The objects of the school are as follows: each man on leaving is guaranteed work. Special lectures are given on growing the material required and on special forms of basket-making.

Up to date fifty men have passed through the school; the best pupils are sent as teachers to the other schools for the disabled.

When a man has finished his apprenticeship, the school does not lose touch with him, but advises and helps him if need be. He can always return to the school at any time if he desires further instruction. In a word, the man knows he has the school at his back when he sets out to face the world once more. It is not sufficient to find a situation for a man; one must see that he is earning a good wage once he is there, and the best way of insuring this is to keep constantly in touch with him. Under these conditions our work must bear fruit,

CHAPTER XI

RE-EDUCATION OF BLINDED AGRICULTURAL WORKERS

BY P. DE CABAUSSEL

AT the present time more than 2,500 men have lost their sight in the war, and of this number more than 2,000 were, before the war, engaged in farm work. To condemn these men to an indoor occupation for the remainder of their lives would be to rob them of the gifts of health and happiness which work in the open air bestows; they must be re-educated to work on the land. Then they will at least have the consolation of being able to do some of the work to which they were accustomed before they became blind. With this end in view, a thorough training of both body and mind is necessary; the latter is of the greatest importance, as otherwise these men are inclined to drift without making any attempt at working, and because they have lost their sight in the service of their country they think that their country should support them in leisure for the remainder of their lives.

These men have even to be retaught to live, and shown that by using their other senses to a greater

extent than formerly they can, in a way, make up for their blindness; they have to be taught to fight against melancholy, which, if it gets the upper hand, increases their helplessness. They must be protected from morbid ideas, and encouraged to take an interest in life, and shown how to fight against despair and hopelessness. They must be taught confidence, and to believe that by working they are still useful members of the community.

Their *practical* instruction consists in Braille reading and writing, learning to do without assistance at meal-times, walking about the buildings, and finding their way alone in the village. Without this instruction the blind man cannot be trained on the correct principles, as unless he is taught to rely on himself he will never dare to attempt anything unless a helping hand is offered him.

Professional Re-education.—At first one would imagine it to be impossible to use agricultural implements without the use of one's eyes, but nevertheless it can be and is done daily. Take the case of one blind man trained at this school; he finds his way to his vineyard along a twisting path, looks after the vines, trimming and cutting off the buds, binds up the branches, and eventually cuts off the grapes for the market.

Others have become farmers, who themselves look after their herds, uproot the beets, give their cattle food and water, groom and brush their horses, prepare their pigs' food, look after the rabbits and

chickens, milk the cows, collect the cream, and make butter and cheese.

The tasks a blind man can accomplish are innumerable; amongst them are the following: Unloading fodder from carts, making bindings, picking fruit and vegetables, washing up cups and saucers, making hay, harnessing their horses, looking after an apiary, doing many odd jobs in the garden, and even driving a plough if someone leads the team for them.

The following letter will give a good idea of how much a blind man can do; it is addressed to M. Brioux, of the Académie Française, who has done so much for the blinded soldier:

“I am about to leave Sept-Fons, and I should like to give you an account of the work I have done here. Until three weeks ago I used to think that a blind man could not work on the land; indeed, my mother and I were most sceptical about this, but my stay here has proved us both wrong.

“I am going away to live on an estate of about 50 hectares, mostly grass land, where breeding is the chief occupation, but I intend starting a kitchen-garden.

“In a few words I will tell you what I was taught to do at Sept-Fons. In the stables I learnt more than I ever knew before; I learnt to milk cows, to look after the pigs, feeding them and cleaning out their sty. In the chicken-run I started by cleaning it from top to bottom; this consisted of taking down

the perches, putting fresh gravel on the floor, sweeping it clean and putting the sweepings in a barrow, and emptying them on to a manure-heap. Then I had to prepare the hens' food and collect the eggs.

"I used to keep one of the yards clear of weeds by using a hoe. In the garden I first had to relearn to dig. This I did by placing a plank on the ground I had to dig up and then pushing in the spade, keeping its back up against the board; when I had withdrawn the spade, I pulled the board back 15 to 20 centimetres and made another stroke, and so on. The only thing one must keep an eye on, so to speak, is to see that the trench does not crumble in, and one can do this by touch.

"After having worked the land, I replanted the leeks which I had previously prepared. I dug shallow furrows alongside a piece of cord stretched between two sticks, or alongside a curtain-rod placed on the ground. Into these furrows I planted my leeks at regular intervals, shifting the cord or rod back 30 centimetres each time I came to the end of the row, and then starting in a new furrow. The same plan holds good for cabbages and lettuces. Gathering beans off sticks is easy, and so is picking lettuces and other vegetables. I am quite sure that what I did at Sept-Fons others can do equally well if they receive as much encouragement as I did.

"I am quite convinced that encouragement is the secret of success. It is not a question of learning a new trade, but of being convinced that one can do

one's old one, with the help of one or two altered methods.

“It is the surroundings that one misses so much, away from the school; I am sure that people who can see want teaching as much as those who cannot, otherwise they would not be continually pitying us and squeezing our hands and saying, ‘My poor fellow, what can you possibly do now?’ All they think us good for is to go round singing patriotic songs with a little dog to collect the money. They do not understand at all; everyone has his own way of seeing, and if they were really charitable they would try to impress upon us that there is no difference between us at all. I have met many people at Sept-Fons who have their sight, and who have been taught true charity to the blind, and I am leaving here full of hope for what the future has in store for me.”

Since the beginning of the war the Association Valentin Haüy has been looking after the blinded soldiers and teaching them, when possible, to take up their previous occupations. The line adopted there is that even if there are special trades suited to the blind, such as brush and basket making, caning and mending chairs, massage, etc., it is much better to let the man go back to his previous work if this be possible. Thus, blind men have been sent back to their old work of barrel-making, shoe-making, cutlery, crystal-cutting, and other trades, which are usually considered as unsuitable for the blind; and

the same holds good for agriculture, which, after all, is one of man's most important works.

The question then arises as to whether a blind man can relearn to work in the fields by himself and without any fellow-pupils. The answer to this is that his re-education under these circumstances would be difficult and slow. If left alone, a blind man will never even guess the number of things he can learn to do; he will hypnotise himself, and *a priori* certain tasks at once become impossible. Without encouragement he will feel his way hesitatingly; he will be hindered by difficulties and lack of success; he will hurt himself, lose confidence, and probably give up trying altogether.

Would re-education among his family meet with greater success? Probably to some extent it would, as everyone would try to help him, but an excess of care and safeguarding would make the man think he is useless, and so this attention, though meant kindly, becomes undesirable.

Friends always believe that a blind man is useless for anything, and that he cannot be relied on to do serious work. They are always afraid that the least work out of doors will result in an accident. Instead of giving the man confidence in himself, they tend to depress him by continually expressing their sympathy, and in this way they magnify his disability, which is, of course, the exact opposite of what they should do.

A blind man must be surrounded by an atmosphere

of helpful and affectionate understanding, and not by an atmosphere that acts as a narcotic.

Lastly, we must consider **technical re-education**—that is to say, systematic and experimental re-education which results from our previous experiences with the blind. To be useful, it must be applied to a number of blind men, both by blind teachers and by those who can see. These blind teachers must have an experience covering some considerable time since they became blind, and must be chosen from amongst those who have had the skill and application to do a number of seemingly impossible tasks.

In their re-education the blind should not work alone, as it is the spirit of friendly rivalry which contributes so largely to their final success. The Trappist monks manage their admirable school at Sept-Fons on these lines.

The Association Valentin Haüy had the good fortune to enlist the services of a farmer who, though blind for six years, still continued his work. This man's perseverance has enabled him to do work with impunity which most people would consider too dangerous or even impossible for a blind man.

Sept-Fons gives preference, whenever possible, to men who before the war were farmers or managed their own property, as well as ordinary field labourers. After they have been taught to earn their living, the school sees that they find a suitable situation.

CHAPTER XII

THE NATIONAL DAIRY SCHOOL AT MAMIROLLE

THE re-education of the wounded in dairy-farming has not up to the present given very good results. Although there is an excellent course of instruction at the National Dairy School at Mamirolle, very few pupils have offered themselves, and this in spite of a circular sent round the various re-educational centres. As a matter of fact, it is very difficult to employ a man on dairy work who has had a limb amputated. There are two principal reasons for this—(1) the work is very hard, (2) a man with an artificial leg is very liable to slip on damp ground. The objects of the school are—(1) To teach cheesemaking; (2) to instruct dairy inspectors; (3) to teach dairy-farming on an extended scale.

With this in view, the pupils are taught—(1) the manufacture of the principal cheeses; (2) laboratory work; (3) the theory and technique of dairy work, including zoology, the chemistry of milk, and the keeping of accounts. The younger pupils, who are being instructed in the groundwork, spend most of their time in practical work.

Some of the work is undoubtedly difficult, and for

this reason, as well as the previously mentioned danger of falling, the use of both arms and legs is practically essential.

The most suitable class of wounded are those who have lost one eye. Men who have lost a hand can be taught to manufacture soft cheeses, such as Camembert and cream cheese.

On the whole, the pay is excellent. Cheesemakers can easily earn 150 francs a month, while inspectors can rise to 200 or 225 francs. Employment is found for all the pupils.

The length of study depends on the special branch taken up, and also on the pupil's ability. Three months is usually sufficient for an inspector to become proficient, and six months for a cheesemaker. In one year the whole science can be mastered.

CHAPTER XIII

**THE SOUTH-EASTERN INSTITUTE FOR
WOUNDED FARM-HANDS**

By E. VORON

THE estate is one of about 45 hectares, and has many conveniences. There are twenty cows, two bulls,



FIG. 38.—HARVESTING.

and several horses, as well as vineyards, meadow land, a fine vegetable garden and orchard, an apiary, a smithy, and a carpenter's shop.

With these varied resources, it is admirably suited for readapting the men in nearly every branch of agriculture. Let me explain what I mean by the word readapting. A large proportion of the wounded worked on the land before the war, and, knowing their work thoroughly, asked only to be enabled to



FIG. 39.—VINE-SPRAYING.

do now what they used to do formerly. To do this we can—

(1) Supply suitable artificial limbs; there is still much work necessary to perfect these, but our difficulties are to a large extent overcome by M. Jullien's excellent tool-holder. It is of no use at all providing a man with an arm or a leg just for show,

as what the man requires is some apparatus that will enable him to do his work.

(2) Study the novel conditions under which these men work. Often some small alteration in their



FIG 40.—M. JULLIEN'S TOOL-HOLDER ADAPTED FOR AN EXTENSOR PARALYSIS.

tools is all that is required, such as the substitution of a Belgian plough for an ordinary one. Minor alterations can be made to sowing-machines, motor tractors, scythes, and spades—sometimes only their

handles require alteration to make them suitable for work which at first sight seems impossible for a maimed man to do.

I think that, as a general rule, a farmer can go back to his work in spite of his wounds. Men who have their own farms furnish the best examples of this, as they are always keen to get back and usually do well. On the other hand, servants and farm-labourers are not so anxious to get back, and many people think they would be well advised not to; I do not, however, agree with this point of view.

The only difference between a servant and a farmer who does his own work is that the former is a dependent. Those people who are opposed to servants going back to the land think as they do because they believe that most employers would not engage a man who had been badly disabled in the war. Certainly, in the country the general servant is called upon to do most things, but the supply is always less than the demand, and in many cases men who have lost a limb have given complete satisfaction. Further, there are some things a wounded man can do as well as an able-bodied one. The loss of a leg need not prevent a man from working in the stable, dairy, or garden, nor the loss of an arm from working in the fields.

It should be remembered that the position of a servant is not any more permanent in the country than it is in town, and that buying a farm, or even renting one, is the best way to become one's own

master. We cannot urge these men too strongly to settle down for good in one of the many farms all over the country, which at present can be bought for a very modest sum.

Their pension, which always goes further in the country than in town, will prevent them from lacking any of the necessities of life. Even if their landlord will not help them, they will always be able to obtain credit until they can pay their own way, and eventually their farm will provide them with a good living for themselves and their family.

In two months they can master their new limbs and the new way of working with them, and during this time they can learn some subsidiary occupation for the days when the weather is too bad to allow of work in the fields.

CHAPTER XIV

SMALLHOLDINGS FOR THE WOUNDED

BY J. NANOT

QUITE recently a Bill was brought before the *Chambre des Députés* dealing with the return of wounded and disabled soldiers to the land. The main idea of the Bill was as follows: The question of the return of these men to the land calls for legislation on the subject, since it is to the country's advantage to encourage it in every way. The flight from country to town is as dangerous as it is unjustifiable, and it must be stopped by some means or other from continuing after the war, otherwise the situation will become serious. The best way to stop this emigration seems to be to offer inducements to the wounded to return to their villages and farms. It is neither possible nor desirable for all these men to come and live in the towns; they would be much better off and much happier in every way if they resumed their old life in the fields after being re-educated back to it.

There is much ground for alarm that if these men do not return to the land, but crowd into the towns, accepting low wages for work they have never done before, there would soon be an upheaval in the

labour world, which is a thing to be most studiously avoided.

This Bill has already borne fruit. A Ministerial Commission has authorised the subsidy of the various agricultural schools for re-education, and the Ministry for Agriculture has opened up new centres for this work; and, lastly, private societies have been formed to find the pupils situations when their training is complete. But these measures should not limit our endeavours at all. At a meeting at the Academy of Agriculture, M. Souchon pointed out the difficulty of inducing the wounded to return to the land, even when they have been through one of the re-educational schools and have learnt their work well; he also pointed out that men who have lived in the country all their lives (apart from those who own their own property) all desire to learn a trade after their wounds are healed which will necessitate living in a town. It is of no use at all merely giving these men a pension; what is really required is to insure their earning a good wage on which to support a family. M. Nouhaud was so much struck by the force of this argument that he brought in a Bill to enable discharged soldiers to buy farms or cottages at a specially reduced cost. Even this plan seems insufficient. The only plan that seems to answer the purpose is to offer these men, on their discharge, the means of acquiring a house with a few acres attached, and so make them landed proprietors in a small way, with an interest in their land.

The only satisfactory way of working this plan is for the State—

(1) To provide money enough to pay interest equal to one-quarter of the rent; this being a yearly gift from the State, the man's pension could be reduced. It seems only fair that a soldier disabled in the war should be treated at least as well as a man who is disabled at his work, and unless the State adopts this plan, the workman is better off than the soldier.

(2) To advance money, as mentioned above, to bear interest, and the repayment of which is guaranteed by withholding some of the man's pension, and by the fact that the State becomes the man's trustee.

In this way, if his wife survives him, she becomes the owner of the property, and this acts as an additional inducement, especially to men with large families.

Another important point is that if all the man's money is held in trust by the State, he has no opportunity of squandering it by unwise speculation.

This seems about the best solution of the problem, as by it both the State and the soldier are profited.

These inducements, which it is suggested should be offered to discharged soldiers, might well be extended to their widows and orphans.

CHAPTER XV

**THE BELGIAN SCHOOL FOR AGRICULTURE
AT PORT-VILLEZ**

BY P. LINDEMANS

IN July, 1915, the Belgian Minister of War equipped an agricultural college at Port-Villez for soldiers who had been disabled in the war. The college has three sides—(1) for agriculture pure and simple; (2) for gardening; (3) for smallholdings.

Thirty hectares are provided for instructional purposes, and also a farm with another 19 hectares. Another farm of 22 hectares has just been rented in order that the practical work may be extended.

Theoretical lectures, as well as practical ones, are given to the pupils, so that they may get the scientific knowledge which is so necessary. The syllabus covers the following subjects: Geology, chemistry, fertilisers, special zoology, breeding and fattening, agricultural machinery, and the keeping of accounts.

One part of the farm is given over to intensive culture, and another to well-stocked stables and poultry-runs.

The accounts are kept by the pupils themselves. A short while ago dairy work and cheese-making were added.

The gardening sector includes market-gardening, fruit and flower growing, and is run by the pupils under the direction of instructors. The garden is divided into different parts; some of it is devoted to model gardens of different sizes, some to a nursery



FIG. 41.—POULTRY-KEEPING.

for fruit-trees, some to hot-houses, and some to gardens in the French and English styles.

Intensive market-gardening is also taught, and in this way sufficient vegetables are grown for the pupils' use, the remainder being sent to the various hospitals. The pupils are thus taught how to pack the fruit and vegetables for transit. The space between the huts has been planted with flowers; this was a particularly

happy idea, as in this way each soldier learnt to take an interest in the looks of his particular plot.

The classes for poultry-breeding and bee-keeping are most useful, as even the most mutilated soldier can earn a good income from these occupations. The poultry-farm has hundreds of incubators and



FIG. 42.—RABBIT-HUTCHES.

large chicken-runs, and there are also rabbit-hutches of the latest types which can take up to 300 rabbits. The pupils are also taught the cutting up and preparation of their skins. There are over thirty bee-hives.

In Belgium smallholdings are greatly sought after, as they are a good means of increasing an artisan's

income, besides providing him with an interesting outdoor hobby.

The school admits any wounded soldier, irrespective of his pre-war occupation. This, in a few words, is what we have done to fit our disabled soldiers for their future struggles—struggles which will, perhaps, be as severe as those in which they shed their blood for their country.

CHAPTER XVI

MECHANICAL TRAINING

BY DR. BOURRILLON

ALTHOUGH, generally speaking, it is hard to induce soldiers to return to the land after they have been discharged, yet a certain number are undoubtedly attracted by the driving of field tractors. With the object of training a good number of tractor-drivers, the Institute of St. Maurice was opened in April, 1915, and an account of the work done there during the past twenty months may not be without interest to those to whom agriculture appeals.

To a certain extent, the use of motor and electric power to work the land, and especially the former, will make up for the shortage of workers due to the war. For this reason, the use of mechanical help must be encouraged, and its advantages made known; but no amount of propaganda can succeed in bringing these motors into general use, unless it can be accompanied by practical demonstrations in various parts of the country.

Country-folk have seen so many motorists held up on the road at various times and doing repairs under the bonnet of their cars, trying to make them start, that they are rather nervous about running

a motor tractor on their own account. In fact, the deciding factor will be the presence near by of someone who understands it, and can repair any breakdown that may occur. This country mechanic receives a very thorough training at St. Maurice. The men who have chosen this work as their profession are taught everything there is to know about electric or internal combustion engines. This training includes soldering, turning, forge-work, tin-working, etc., and when they have mastered these, they are then taught to handle a tractor. Personally, I believe that the more of these mechanics there are scattered over the countryside, the easier it will be to introduce new methods and new machinery for use on the land.

These men require five or six months' training at least, and one must resist the temptation of sending them out after two or three months, when the knowledge they have acquired is only superficial. True, in a short time a man can drive a tractor well, but he would probably be unable to repair any breakdown that occurs, and the owner would at once regret the money he had spent on a machine that refused work and could not be put to rights. Indeed, this is the best way to discourage him, and, naturally enough, his neighbours also.

The mechanic must be capable of replacing any part of the machinery if necessary, and must know what to write for if he has not the spare part in his outfit. It may be queried as to whether a man who

has never been used to machinery can possibly amass this knowledge in so short a time with any prospect of success. No doubt one must choose one's pupils with care, and experience teaches us that men who have had an arm or leg amputated, especially the former, are unsuited for the work. One must remember that in actual practice a man is continually moving about, either getting up to or down from the driving-seat, sometimes even when the machine is in motion, and that in most cases he has also to look after the plough or harrow he is towing.

If one realises this, one can understand at once that this kind of work is not suited to men who have lost a limb. Certainly, a one-legged man can do the repairs well enough, but he cannot drive the tractor, owing to this continuous mounting and dismounting. One must take all this into consideration before advising a man to take up this kind of work. How often have I seen men spend time and trouble in making themselves efficient in some profession, and the first day they go to do the work by themselves find that they cannot manage it at all.

A tractor-driver must have the use of all his limbs, except in very rare cases. There would be more than enough pupils for this kind of work if only the wounded would abandon the idea, so deeply ingrained in some of them, of finding some place where the work is negligible. There are many men who, though disabled and unfit for service, still have the

use of their limbs, or who have some slight paralysis which does not affect their efficiency for this kind of work, but which will not permit them to resume their pre-war work. It is from this class of man that we can pick suitable pupils for driving. Take, for instance, the case of a man who has an ankle ankylosed at right angles (which is a bad position for working in the fields), and although he cannot dig and push barrows, he can certainly drive and repair a tractor. The same applies to certain shortenings of legs or arms resulting from badly united fractures.

All pupils must show they have sufficient intelligence and inclination for mechanical work before their training is commenced. Many employers are distinctly prejudiced against engaging a wounded soldier, and it is our duty to overcome this prejudice by turning out men capable of doing the work they profess to be able to do.

The following is a list of results from May, 1915, to November, 1916, at St. Maurice:

Sent away after at least one month's trial ..	7
Sent away for disciplinary reasons	4
Sent to hospital	4
Sent to another school	2
Destination unknown	3
Returned home after their apprenticeship ..	3
Placed in situations	28
Still remaining	28
<hr/>	
Total ..	79

132 PHYSICAL AND OCCUPATIONAL

PROFESSION OF THE PUPILS BEFORE THE WAR.

Carpenter	1	Mechanic	6
Chocolate-maker ..	1	Miner	1
Cotton manufacturer ..	1	Fitter	1
Cook	1	House-painter ..	1
Farmer	29	Locksmith	3
Business clerk	7	Weaver	1
Engraver	1	Tyler	1
Mason	2	Valet	3
Bricklayer	4	Glass-maker	1
Marble-cutter	1		
Farrier	5		
Sailor	1	Total	72

FUNCTIONAL INCAPACITY.

<i>Loss of Limbs.</i>	<i>Upper.</i>	<i>Lower.</i>
Amputations, disarticulations, etc.	3	13 = 16
<i>Weakness.</i>		
Ankylosis, resection, paralysis, and fractures	10	42 = 52
<i>Head.</i>		
Trephining	1	= 1
<i>Body.</i>		
Fractured pelvis	1	= 1
<i>Various.</i>		
Loss of eye	2	= 2
	Total	72

This table shows the large number of farmers attracted by tractor work, and the large proportion of farriers who have offered themselves for training. It also shows the great excess of wounds over amputations, which were the cause of a large number of the rejections. Some of the pupils were eventually sent to farms and others to the various tractor manu-

facturers, who sent them to exhibit their goods, or to deliver them and teach the purchasers the art of driving them. It would be indiscreet to mention the wages these mechanics receive, even if it were possible, which in most cases it is not, as it varies according to the individual's capabilities, but this much one can say, however, that they receive a much higher wage than an ordinary farm-labourer. I am convinced that to become a farm mechanic is an excellent thing for men who are willing to return to the land; it attracts many men who are disabled and cannot do their former work. I do not consider it suitable work for men who have lost a limb. The wages are excellent, and the mechanical tractor can be made to make up for the present shortage of labourers.

CHAPTER XVII

AGRICULTURAL RE-EDUCATION

BY DRs. BELOT AND PRIVAT

ANYONE who has made a study of the treatment of wounded men by mechano-therapy cannot help being struck by the insufficiency of this method. The method itself is excellent, no one doubts that, but in all cases in which it is applied, whether for stiff joints or muscular weakness, it calls for the most complicated and costly machinery.

This is neither the time nor the place to discuss the relative values of active and passive movements, but every surgeon who employs mechano-therapy would admit that without his apparatus he would be quite helpless as regards this form of treatment.

It demands much attention to the patients, and the machinery has constantly to be readjusted; even so, this is not the most serious fault that can be found with this form of treatment. In spite of the ingenuity of the makers, the number of different movements that can be accomplished is strictly limited, and at times they are even totally unphysiological and unsuitable.

In addition to mechanical movements, there is,

of course, massage, and the whole is grouped under the rather clumsy name of kinesitherapy. When employing mechano- or kinesitherapy, it is essential to make the treatment last some time, as no surgeon would be bold enough to claim that five minutes' exercise on a mechanical rocker, followed by massage, is enough to produce a quick and complete cure for an ankylosed joint.

In peace-time all that was required was a very complicated apparatus and a short treatment, and this was quite sufficient to attract a large number of *malades imaginaires*—the main principle being not to overtire the people who liked to take their exercise in this way. Of course, this kind of treatment is useless in dealing with the wounded, the object being in this case to make them fit for the army as soon as possible, or, if they have been too badly disabled, to make them well enough to earn a living in some profession or other.

Energetic treatment is then obviously necessary, and the length of each sitting may have to be increased fourfold, at the same time encouraging the men to go for walks and to play games, our object being to increase the amount of exercise taken to the fullest extent, without causing undue fatigue.

Since the beginning of the war we have always thought that the best form of exercise would be one which called into play all the muscles of the body, and it seemed to us that for the men who were not too badly wounded work in the fields was just the

thing that answered this purpose. We argued that with a certain degree of supervision, and by regulating the amount of work, and by getting the men interested, we ought to get excellent results.

Having obtained the necessary permits for this treatment ("complementary treatment by agricultural mechano-therapy"), we consider that the results we have obtained during the past two years justify us in recommending it thoroughly.

Value of the Treatment.—There is no doubt that work in the fields is a most excellent form of treatment for many varieties of stiff joints, atrophies, and limitations of movements. When using some mechanical exerciser, the patient has nothing to show for his work, whereas when he is working on the land he can measure the extent of his progress by the work he has done. A very slight knowledge of agriculture will tell us that, with its infinite variety of different tasks, there should be no difficulty in finding a form of work which will exercise any particular part of the body, or, indeed, the whole body.

For instance, in hoeing the movements at the shoulder are slight, at the elbow they are active, at the wrist they are strong, but limited, while the fingers are continually gripping the hoe. The vertebral column, abdominal and lumbar muscles, all take a certain part in the work, as the man stoops and straightens himself with each thrust of the hoe;

and, lastly, the body is bent on the thighs and the legs flexed and extended alternately as the man advances slowly. Thus, hip, knee, and ankle are moved gently and regularly.

Another kind of work, which requires more effort and is kept for the less badly wounded, is using a scythe. Here the man's arms must be strong; his fingers grasp the scythe, his elbows are flexed and extended rhythmically, and his shoulders and wrist joints are in continuous movement. The muscles of the arm do most of the work, and it is a wonderful cure for muscular atrophies. While the stronger men are scything, the others can toss and load the hay or bind and stack it. This kind of work, though less active, answers our purpose admirably in some cases. Later on in the season, the patients can assist in gathering in the fruit—excellent work this for stiff fingers!—while later on still comes the preparation of the nut harvest; removing the husks and shells is also good work for stiff fingers. After the summer-time comes the harvest, and after the harvest the ploughing, and a plough exercises a man's hands and arms better than any mechanical contrivance, however ingenious; at the same time the trunk and legs are exercised, as they have to take some of the weight required to keep the plough running in a straight line.

What, then, is the use of expensive and complicated apparatus when all this is at hand? Surely the best exercise is one which produces natural and

normal movements, and what is better than agriculture for this ?

Work in the fields exercises the whole body, and by its enormous variety can be made suitable for any complaint that needs exercise.

Everyone knows that a man works better if he has an interest in his work—this experiment shows it well. Take a man with a shoulder stiff from a recent wound, and put him on to turning a wheel; he will do it well for a few minutes, and then slow down and stop. Next to him put a man with the same disability, but instead of a wheel, give him a pump-handle to turn; although the work is harder, he will do it better and go on for a longer time. In the first case the work was dull and useless, and in the second case it was more interesting and useful; and as the man felt he was doing something useful, he kept on for a longer time.

In the fields a man sees that his work is useful and that it bears fruit, and he knows that it is essential to his country, and so he works conscientiously.

In working a scythe or in tossing hay a man uses much more energy than when using one of Zander's machines, and yet the movements of flexion, extension, and rotation are the same; and while he displays absolutely no enthusiasm for mechanical treatment, he is full of joy and happiness at being able to work in the fields. He will work there all day, forgetting he was ever wounded, and certainly one would not even suspect it if one watched him

at his work. He is no longer a hospital case, with doubts as to his treatment, but a peasant who is working on the land and putting his whole heart into his work.

Men often become so enthusiastic when they are allowed in the fields that in many cases we have been compelled strictly to limit the amount of work undertaken. The men are always anxious to please their employer in every way, and to repay him to their utmost for the trouble and expense he has in boarding them.

Men who have worked the land all their lives (and this is the type we choose when possible) believe themselves to be back in the happy days of peace, and they work without a thought for the weakness their wound has left them with, and so tend to over-tire themselves. To avoid this, we have had to give orders that the work should be gradually increased, starting with light work only, and that there should be definite rest-hours, and, in addition to this, that every man who is doing heavy work should only do it on alternate days, doing light work in between. The variety of agricultural work is only one of its advantages, and mention must be made of the incalculable moral benefits which accompany it.

If one takes a little trouble in grouping the men, always getting a good proportion of former agricultural labourers into each group, work in the fields completely changes the patient's morale. The man is pleased to leave hospital, where, perhaps, he has

been under treatment for several months, and to return to the land to relive his pre-war life. In the farmhouse he is sent to, in the animals he is looking after, in the harvest he is helping to gather, he pictures his own farm, cattle, and fields. He forgets, as if by magic, the sufferings and hardships he has been through, and they will never enter his head until the evening-time comes, when he will relate his experiences over the supper-table to the old men and women who have been left behind. He will work all day without noticing that his old wound is hurting him, because he is once more back on the land he loves, and so he will be continually exercising his bad limb without ever even realising it.

Compare this system of voluntary exercise in the fields with the old system of mechanical movements—what a difference! Sunshine and fresh air will make a new man of him, in a few days he will regain the colour in his cheeks and become sunburnt, and the open air will soon restore all the old *joie de vivre* that he had lost in hospital.

Organisation.—To get the best results from this treatment, all work must be carefully supervised. The first and most important thing is the choice of the men, who must not be picked out in a haphazard way. There are two guiding principles—(1) the kind of work the man has been accustomed to, and (2) his physical condition.

An ankylosed joint, a limitation of movement due to some bony obstruction, and paresis due to a

nerve lesion, are examples of what should be avoided in choosing a man for a team of workmen. Certainly men with these disabilities are not likely to damage themselves further, and probably could do some useful work, but their physical condition would not be improved.

It is quite a different matter when dealing with stiff joints due to contractures or the results of prolonged immobilisation, as well as muscular atrophies or loss of power due to want of use; in these cases work does good in restoring the full use of the limb. Naturally, some men have been too badly damaged to be sent out in a team—in fact, every case must be treated on its own merits.

As far as possible, we try to choose farm-labourers for the teams we send out; there are always a high percentage of them among the wounded. This is essential to the smooth working of our scheme. Before leaving, each man is carefully examined, both physically and for the amount of work he is capable of doing, and an N.C.O., who knows each man's capabilities in the team, is always sent away with them in charge.

On their arrival at the village which has asked for men to work in the fields, the N.C.O. arranges with the Mayor as to where the men are to be billeted. In doing this, he must take into consideration each man's disability. For instance, the men who find difficulty in walking are sent to the farms which are nearest at hand, and which only cover a small

acreage, while the men who are nearly fit are sent to farmers who require some heavy work done, such as ploughing.

Further, the N.C.O. must see that the men get good food, and that they are not overtaxing their strength. He has full power to take them off any job if they are not being well looked after or if they cannot do the work.

Lastly, from time to time we ourselves pay them visits, watch them at their work, and see that they are progressing well.

Under these conditions work is a most valuable curative agent. Each group is sent out for three weeks or a month, according to the circumstances. The farmer is required to pay the men he receives a certain minimum wage, which is highly appreciated by them. On his return each man is examined and boarded, and, being in most cases fit, he is sent to his depot after the regulation seven days' leave.

This team-work gives much better results than individual work; our experience has been that the men we have sent home to work on their own farms have gained no benefits at all, and some came back even worse than when they left us. The reason for this is that under these circumstances they do not work regularly, nor do they increase the work as they get better, as there is no supervision.

The man who is sent home often works much too hard, and as a consequence any stiff joint he may have swells up at once, and cannot be used for some

days. True, in other cases the man does no work at all, regarding it in the light of a holiday and not a cure. At this critical time, when individual must give way before national interests, we consider that all work should be carried out under the team system.

Results.—The organisation of this treatment has enabled us to furnish the district we are working in with a continuous supply of workmen. We have thus succeeded in curing our patients at the same time as providing manual labourers at a period when they are so scarce. From June to September we supplied more than 15,000 days' work, and even this record will shortly be surpassed.

The medical results are even more astonishing. No accidents or aggravations of previous injuries have occurred; 3 to 5 per cent. no change; 10 per cent. slight improvement; 80 per cent. rejoined their depots. These magnificent results are astonishing, but nevertheless accurate. The most important part is to choose one's patients well and to look after them carefully. We do not wish it to be believed that all that is required is to send a wounded man to work in the fields, and that he will come back cured.

All one has really done is to replace a highly specialised treatment by machinery by a simple and purely empirical method. Both methods are identical in theory: in one the patient works in the open air from sunrise to sunset, resting during the heat of the day, while in the other he lifts a few

weights, turns a wheel, or works a lever, for not longer than a few minutes during the whole day.

Far be it from us to try to push our ideas forward in preference to the old system. Both systems have their uses and their successes. One can even say that the one is complementary to the other, as the more badly wounded can have their limbs moved passively before they go to work in the fields.

All our methods are easily applied in any country, and we wish to acknowledge the help our patients have given us by their goodwill and enthusiasm. They have given an excellent example of the saving of man power to the nation, as, although not well enough to fight, they have come forward to help the farmer gather in his crops, which at the present time are as essential as munitions. At the same time they have found themselves getting better, and 80 per cent. have been able to return to the front.

CHAPTER XVIII

OCCUPATIONAL RE-EDUCATION

BY H. NEPPER AND CH. VALLÉE

IN our researches on the wounded we have tried to measure accurately, by means of the energographic method, the extent of disabilities due to various wounds. For this we have used two machines, especially constructed for us by Dr. Jean Camus, one of which was used for the coarser movements of arm or leg, and the other for the finer movements of the hand and wrist.

The tracings shown here were taken from these machines, and show the effect of work on the wounded. We questioned ourselves as to whether, by giving a wounded man some work to do, we might not in some cases increase his physical incapacity, but our experience has taught us that not only is there no fear of this, but that work, well supervised, is one of the best means of treatment we have.

Yet we must prove this, and to do this we took a number of tracings of men with various wounds to show how much work they were capable of before they had received any treatment, by mechano-therapy or otherwise; a few weeks later we took a

146 RE-EDUCATION OF THE MAIMED

second series from the same men, and we have chosen a few tracings as examples.

Tracings IV. and V. (traction and propulsion) were taken from a bootmaker, the calculations being in kilogrammetres.

In the previous example one sees that (1) on August 23, 1916, the greatest resistance the man could work against was 14 kg. 800, with a total work of 133 kgm. 2 while pulling and 64 kgm. 6 while pushing. (2) On November 10, 1916, the resistance could be raised to 22 kg. 200, an increase of 33 per cent., with a total work of 399 kgm. 6 while pulling and 266 kgm. 4 while pushing. This shows the improvement from systematic work.

We could give many more examples, but the tracings are more eloquent than words. We think we can safely say that the wounded benefit greatly by working, that it never does them any harm, and in some cases it is the only treatment that is of any use at all.

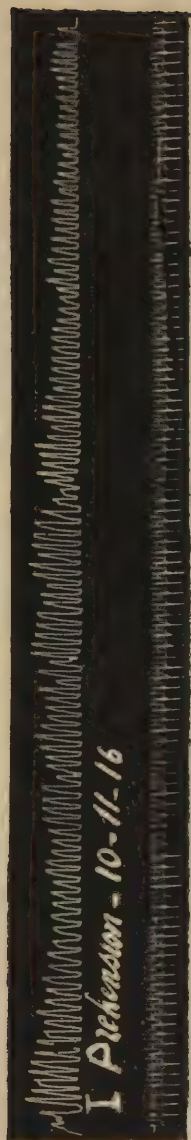


FIG. 43 (TRACING I.).—HARNES-MAKER.

Ankylosis of left wrist, with paresis of extensors.

Gripping power {	Top: Sept. 20, 1916	{	A comparison of the tracings shows the improvement made. The strength of the grip has more than trebled.
	Bottom: Nov. 10, 1916		

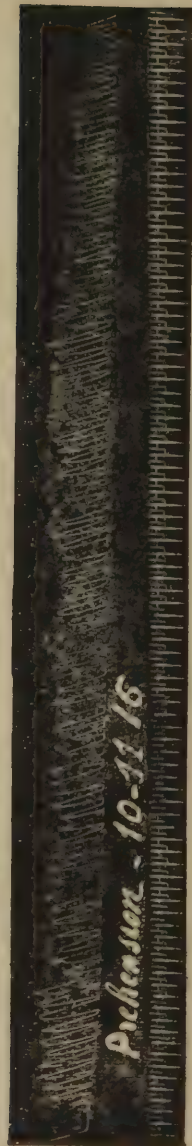
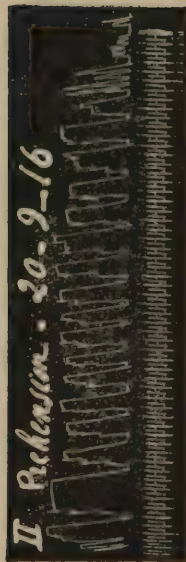


FIG. 44 (TRACING II.).—MECHANIC.

Stiff wrist and fingers, with no flexion. Limited pronation and supination.

Gripping power { Top: Sept. 20, 1916 { Progress made was enormous.
 Bottom: Nov. 10, 1916 { From nearly nil in September,
 it rose to a quarter of normal
 in November.

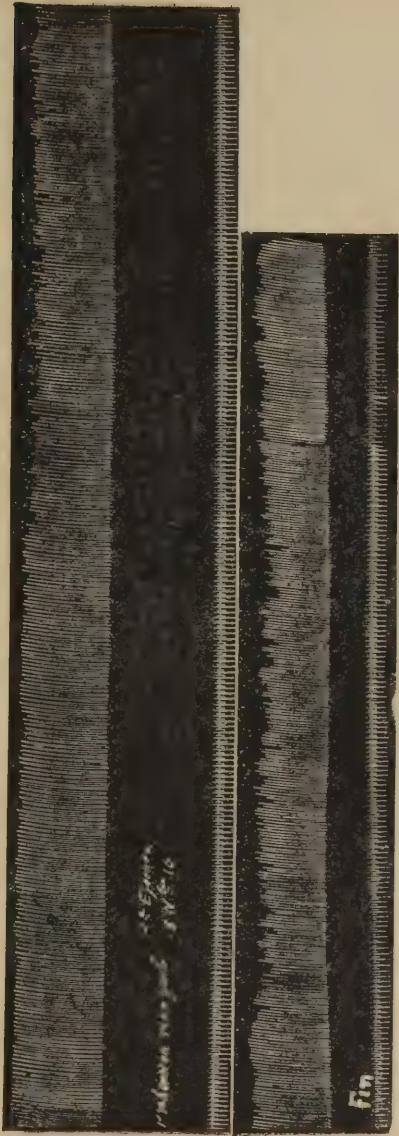
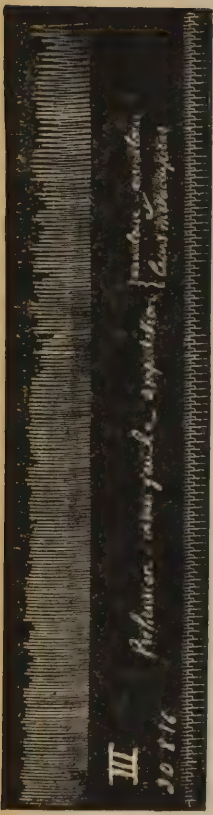


FIG. 45 (TRACING III.).—CARPENTER.

Amputation of left ring and little fingers with their metacarpals.

Gripping power { Top: Aug. 30, 1916 { A comparison of the tracings shows the improvement made.
 { Bottom: Nov. 8, 1916 { In November the grip was normal, and fatigue showed itself much later.

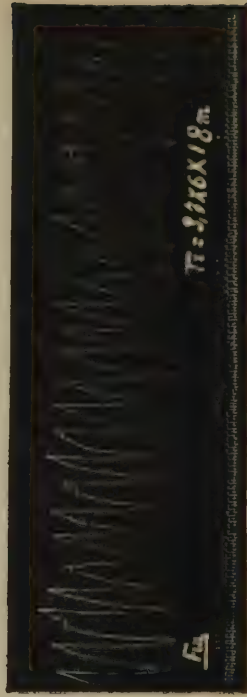
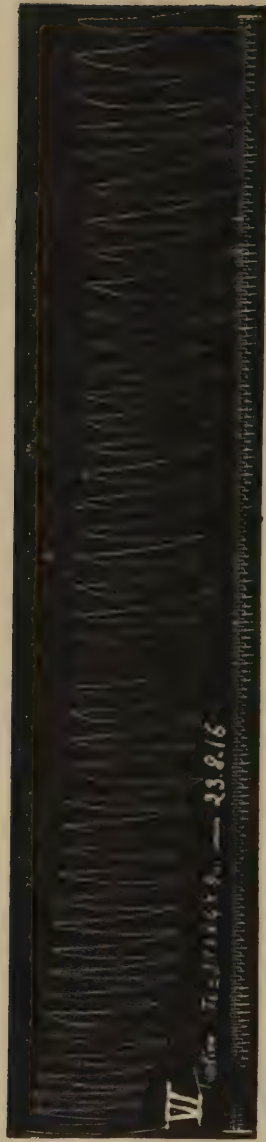


FIG. 46 (TRACING IV.).—BOOTMAKER.

Lesion of right brachial plexus.

Oct. 23, 1916: Resistance 14 kg. 8.

Nov. 10, 1916: Resistance 22 kg. 2.

Total work increased from 133 kilogrammetres to 399.6 kilogrammetres.

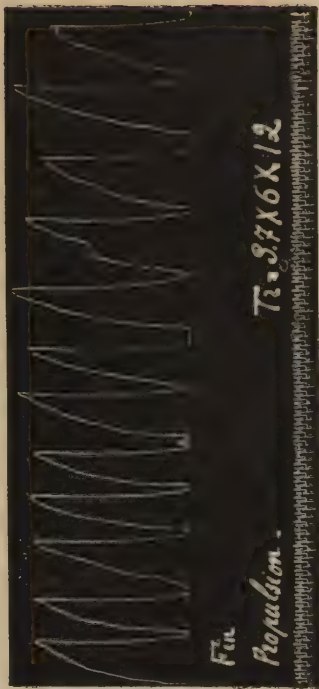
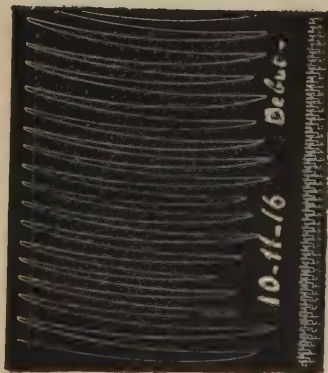


FIG. 47 (TRACING V).—BOOTMAKER.

Lesion of right brachial plexus.

Aug. 23, 1916: Resistance 14 kg. 8.

Nov. 10; 1916: Resistance 22 kg. 2.

Total work increased from 66.6 kilogrammetres to 266.4 kilogrammetres.

CHAPTER XIX

**RE-EDUCATIONAL SCHOOLS OF THE UNION
DES COLONIES ÉTRANGÈRES**

BY DR. JEAN CAMUS

LAST March I received instructions directing me to look round for a house suitable for an instructional school, and not too far away from the hospital at Enghien. This school was to be organised by the Union des Colonies Étrangères. At this time I knew nothing about this society, its members, or its objects, and I confess that I had grave doubts as to the success of the enterprise when I heard that its members were of fifteen different nationalities. However, I soon changed my mind when M. Ernest-Charles and Dr. Haret (sent by the Under-Secretary for State) arrived on the scene with a number of gentlemen who spoke French perfectly and were most anxious to get on with the work.

The houses near Enghien were unsuitable, and so the idea of a school in this district was abandoned, and eventually, through the goodness of M. Justin Godart, we were offered part of the Grand-Palais in the Champs-Élysées. The choice of teachers was soon made out of the large number of wounded put under our care (over 2,000); one can quite under-

stand that out of so large a number it was easy enough to find several men who were specialists in the various trades, and who were all able and willing to undertake the management of the workshops.

The success of the movement was insured from the start, but the results have been so good as to encourage the society greatly. At the present time the society is responsible for four huge schools for the wounded, and is doing work unsurpassed in France and perhaps in the world.

The society can teach the wounded any of the principal professions, and can undertake a man's re-education from the time he leaves hospital until he is fit once more for civil life.

The wounded still requiring medical attention are sent to the Grand-Palais, where they are only taught town occupations.

Agricultural re-education is provided at the Jurisy school.

The college at the Maison-Blanche is only for the men awaiting artificial limbs. The men who have been discharged from the army without having a trade are sent to the Quai Debilly. The wounded who go to the Quai Debilly have often passed through the Grand-Palais or the Maison-Blanche, the different schools working together harmoniously.

In this brief résumé one can see what splendid work the society has done, and how well the schools supply the wounded man's needs.

The **Grand-Palais** school has 350 pupils, and is meant especially for the badly wounded, who will certainly be invalided out, but still require some medical attention. They are in the doctor's hands for half an hour or an hour daily, and the rest of the time is spent in the shops.



FIG. 48. —WORKSHOP FOR CARPENTERS AND CABINET-MAKERS AT THE GRAND-PALAIS.

The trades taught are numerous, and include bootmaking, harness-making, carpentering, cabinet-making, wood-carving, lock-making, tin-working, electricity, picture-framing, cutting and tailoring, account-keeping, typewriting, and shorthand.

As most of the wounded are still under medical treatment, they are clothed and fed by the military authorities, and at the same time they are taught a trade. All the wounded are chosen because of the

severity of their wounds; and as very often a prolonged medical treatment is necessary before they can be discharged, the time spent in the Grand-Palais is often considerable.

Men with peripheral nerve lesions usually have a long stay in hospital, and so they get a good chance of learning a trade before leaving. Any surgeon



FIG. 49.—BOOT-REPAIRING AT THE GRAND-PALAIS.

in charge of such a case can always get his patient admitted to the Grand-Palais if he is suitable.

Periodic reports are sent round to nerve specialists informing them of the progress these cases are making.

The **Maison-Blanche** school only receives the wounded who have lost a limb and are awaiting a prosthetic apparatus. The time required to fit an



FIG. 50.—MECHANICAL WORKSHOPS, MAISON-BLANCHE.



FIG. 51.—CARPENTER'S SHOP, MAISON-BLANCHE.

artificial limb is usually considerable, and it would be a pity to waste it.

The society has no lack of funds for re-educational purposes; as soon as they decided to manage this school, they cabled to America for money, and within forty-eight hours their subscription list had



FIG. 52.—ONE OF THE ROOMS IN M. AND MME. DE WENDEL'S HOUSE IN THE QUAI DEBILLY, SHOWING AN ACCOUNTANT CLASS AT WORK.

been oversubscribed, one gentleman promising £16,000.

The school was opened in July, 1916, and the subjects taught are the same as those at the Grand-Palais, but an agricultural section has been added as well.

Six hundred and sixty-four men have passed through the school since its foundation, 410 of whom

returned home to work or had situations found for them, and at the present time there are 350 men on the books.

The **Quai Debilly** school is in a magnificent house lent by the kindness of M. and Mme. Maurice de Wendel; it is chiefly intended for teaching town occupations, and can accommodate and lodge 100



FIG. 53.—THE WOUNDED AT JUVISY.

patients. Lectures are given and debates, concerts, etc., are arranged to distract the pupils from their troubles.

The Agricultural School at Juvisy.—In my report on the care of the wounded in 1916, I suggested the formation of a new agricultural centre, observing the large number of wounded then in the country. This suggestion was acted on, and one was established

at the Juvisy hospital to accommodate 500 patients. This school was really necessary, as large numbers of wounded were being sent to hospitals, where they were taught anything but agriculture, and it seemed a pity that this should be so at such a critical time. The society, with its usual generosity, at once accepted the management of the new school.



FIG. 54.—MARKET-GARDENING AT JUVISY.

Various courses and lectures are given in agricultural mechanics, including the driving and repair of tractors. Dairy-work, cheese-making, intensive culture, poultry and bee keeping, are also taught.

The wounded fall into two classes—those who will get quite well and those who will never be fit for service again. These latter, unable to do the heavy work in the fields, are taught to specialise in one of the lighter branches, and they soon realise

that they are better off doing this than rushing off to a miserable situation in a town, which so many of them seem so anxious to do. For two months now over one hundred men have been working happily in the fields, rejoicing in the land they love.

The men who are going to be fit for service have in their spare time an excellent opportunity of learning the latest methods and improvements in agriculture, and as they come from all over France, these new methods are spread, and the whole country benefits thereby.

APPENDIX I

**LORD ROBERTS MEMORIAL WORKSHOPS FOR
DISABLED SOLDIERS AND SAILORS**

BY MARGARET SALE

OF all the institutions dealing with the occupation or employment of disabled men, none has attacked the question in so thorough and business-like a manner as the Lord Roberts Memorial Workshops. In the first place, this institution only deals with men discharged from the Navy or Army who are already in receipt of their permanent pensions from the Government. It undertakes to train these men, as far as their disabilities allow, in a practical trade, and, further, it guarantees them permanent employment in that trade at a living wage, which is quite exclusive of their Government pension.

The scheme is an enormous one, and is capable of development to an extent that will enable the workshops to become a very potent force in the industrial world.

Lord Roberts was greatly interested in the whole question of the employment of disabled service men, and shortly before his untimely death was in consultation with the Soldiers' and Sailors' Help Society

regarding a great development of the small workshops which already existed under their auspices at 122, Brompton Road. It was therefore decided that the public money raised as a memorial to him could be put to no more noble use than in carrying out this scheme, and accordingly, in March, 1915,



FIG. 55.—ONE-ARMED MAN USING FOOT-PRESS.

the central workshops at Fulham were opened, a good wood-working plant was established, and the first men were started at toy-making and other trades.

Since then the development of the whole scheme has been very rapid and extensive. Ten provincial

branches have been opened, each branch being designed to cover a certain area of the Kingdom, so that men who do not wish to leave their own locality can find employment there. At every branch the industry chosen has been one which will co-ordinate with the others, making a concerted whole of the organisation. Thus, in Birmingham metal-work is done, and the metal parts of the goods produced at other branches are made. In Bradford a large printing works is established, which supplies all the printed matter, catalogues, posters, labels, etc., for the whole organisation, as well as taking orders from outside firms. In Edinburgh a large brush factory is started, while at Newcastle, Nottingham, Liverpool, Plymouth, Colchester, Brighton, and Belfast, other co-ordinating trades are carried on.

The Central Workshops in London direct the work of the whole organisation, and at the same time have developed their own part of the work very greatly. Apart from the wooden toys, which are now produced in thousands and find their way through wholesale dealers all over the civilised world, a large part of the London workshops is given to the manufacture of wooden household articles, which before the war came almost exclusively from Austria. Jointed dolls have an important place in the list of products, many different sizes and kinds being made from beautiful models. The workshops do all their own designing, and set their standard very high.

There are also sections of the workshops given up to leather-work, basket-work, and the repairing of antique furniture. It is hoped before long to start a complete furniture section, but this must await the completion of a four-storey building which is being added to the present premises. A part of this



FIG. 56.—ONE-ARMED MAN PAINTING TOYS.

building is to be arranged as canteen and recreation-room for the men, and it is hoped, if funds allow, to establish similar rooms at every branch workshop.

And now as to the methods of allocating the funds subscribed by the public. As the aim of the committee is to make the workshops self-supporting,

the fund is only used for the acquiring and equipping of the various buildings, but it is prepared to support such loss as must necessarily be sustained in the initial work at any of the factories. If, however, the public and the trade support the great scheme

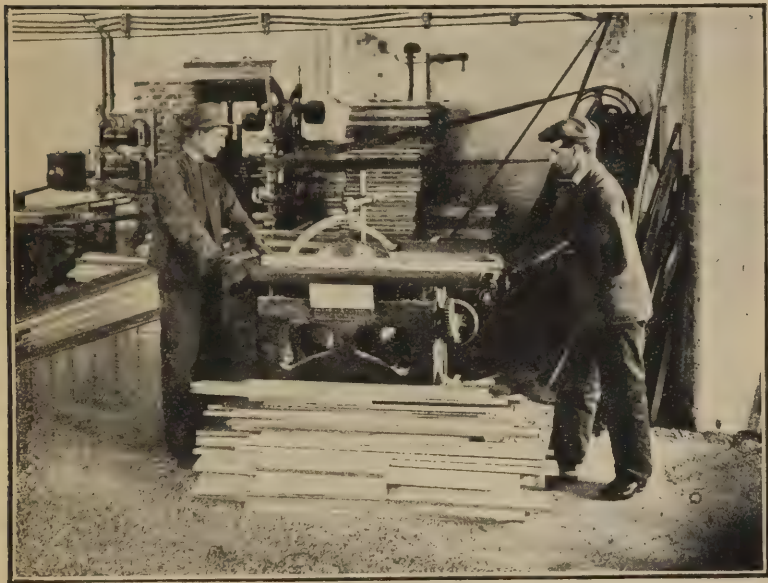


FIG. 57.—ONE-ARMED MEN USING A CIRCULAR SAW.

as it deserves by buying the products of the many factories, and if the disabled men are prepared to work well and justify the money that is spent on their instruction in the trades provided, there seems no reason why the organisation should not become a complete commercial success.

No disabled man is refused admittance, and everyone is paid on entering the workshops £1 per week, which at the end of a month is increased to 22s. 6d., and at the end of three months to 25s. His wage is then increased according to his industry and ability, but at the end of six months in the workshops the minimum wage is 30s. per week. The wage, be it noted, is always exclusive of the man's disability pension which he receives meantime from the Government.

The Pensions Ministry have lately requested the workshops to act as a training-school for one-armed men sent in under the auspices of the War Pensions Training Scheme. The men entering under this arrangement will work side by side with those who come into the workshops direct, but they will receive their training allowance from the Government for a period of six months, being subsequently retained in permanent employment at a minimum wage of 30s. per week.

APPENDIX II

**LIFE AT ST. DUNSTAN'S : THE TRAINING AND
RE-EDUCATION OF THE BLINDED SOLDIERS**

BY SIR ARTHUR PEARSON, BART.

SOLDIERS and sailors who have lost their sight at the war are taught to be blind, re-educated and trained at St. Dunstan's, Regent's Park, London.

The methods of treatment there differ entirely from those necessary in the cases of men suffering from any other form of disablement, for the men who have been rendered sightless have literally to learn to live their lives anew.

In the early stages of his disability a newly blinded man requires help and assistance in the simplest matters of everyday life, and great care is taken at St. Dunstan's to initiate him into the best methods of readapting himself to his new and puzzling conditions. It is in reference to matters of this kind that the expression "taught to be blind" is used.

The actual re-education and training is divided into two sections—that of the class-room and that of the workshop. The men's working days are divided between these two. Those who are in the workshop in the morning are in the class-room in

the afternoon, and *vice versa*. The hours of work are short: from 9.30 to 12 in the morning and from 2.30 to 4.30 in the afternoon, with an optional extra hour morning and afternoon for those who desire it. Working under the handicap of newly inflicted blindness imposes a very much greater mental strain than those who can see would imagine, and there is no doubt that one of the main reasons for the remarkable speed with which the men of St. Dunstan's acquire their knowledge and learn their handicrafts is the shortness of their working day.

In the schoolrooms men are taught to read Braille. The facility with which they acquire this depends not only upon their intelligence, but upon the sensitiveness of their touch. It is quite a fallacy to suppose that a newly blinded man immediately acquires an exquisitely delicate sense of touch. Some men prove to possess so poor a sense of touch, and some have been so badly educated in the past, that they are quite unable to master the difficult art of tactile reading. But these cases do not amount to more than 10 per cent. of the total. The men of St. Dunstan's also learn to write in Braille with the aid of an ingenious little machine.

The acquisition of Braille imposes a great mental strain on most men, so their lessons are broken by work in the adjoining netting-room. Netting is the simplest handicraft which a blind man can learn, and, while not ranking as an industry, may be called a paying hobby, at which it is easy to make a few

shillings a week in spare time. The most careful search has been made to discover the largest possible variety of saleable articles made by netting, and the range of work is much more considerable than would be supposed.



FIG. 58.—BLIND MEN TRAINING AS MASSEURS.

Typewriting is also taught in the class-rooms. It is found that almost every man is able to acquire the art of typewriting. The rapidity with which they learn and the accuracy with which they write is very noticeable. Generally speaking, typewriting is not taught as an occupation, but in order to enable a man to continue to communicate with others by writing, for the handwriting of a blind man inevit-

ably and sometimes very rapidly deteriorates, and the faults which are most apt to develop in it are those which the typewriter automatically corrects. The typewriters used are ordinary Remington machines with the addition of a Braille scale. Special machines with ingenious appliances for the use of men who have only one hand have been built by the Remington Company in consultation with the experts of St. Dunstan's. It has been generally forgotten that the typewriter was originally invented to enable persons who have been blind from infancy to write, an art which would otherwise be impossible for them to acquire. Every man is given his own typewriter when he has passed the writing test imposed, and arrangements have been generously made by the National Library for the Blind for the free lending for life of any quantity of Braille literature.

In the workshops the largest number of men will be found to be learning cobbling, an occupation for the blind which was very little practised until it was developed at St. Dunstan's. A blind man in the course of six or seven months can learn to sole and heel a pair of boots as well as this can be done, and those who have passed through St. Dunstan's, having acquired this industry, are making good earnings. The cobblers are also taught mat-making, for the one disadvantage of cobbling is that work may sometimes be slack, in which case resort can be had to the mat-frame, thus securing constant employment,

and providing another occupation at which good earnings are to be made.

Some men learn mat-making only. It is the easiest of the regular occupations for the blind. The profits are quite satisfactory, the one objection being the monotony of the work. Pupils are also taught



FIG. 59.—BLIND MEN IN THE MAT-MAKING WORKSHOP.

to repair worn door-mats, and to make the plaited openwork mats which are often used in exposed situations.

Basket-making, the oldest of the staple industries for the blind, is taught in many varieties. St. Dunstan's does not profess to turn out a man who is a complete master of the art and can make every

kind of basket. Men are taught to make baskets of a few saleable descriptions, and care is taken to ascertain whether any particular kind of basket is in special demand in the locality in which they are to settle.

The other industry taught in the workshops is joinery. Here, again, a man, unless, indeed, he has been a joiner before his disablement, is not taught to be a complete all-round joiner, but learns to make a few saleable articles, such as picture-frames, tea-trays, corner cupboards, ornamental tables, etc. Practice enables these to be turned out as well and as quickly as they can be made by a sighted workman, and here, again, earnings of men who have left are on a very satisfactory level.

The men of St. Dunstan's acquire these industries in a quarter the time that is usually supposed to be necessary to teach a blinded man a trade. The principal reason for this is to be found in the free employment of the blind teacher, who is not encouraged at ordinary workshops for the blind. The whole outlook of a man becomes different when he finds himself in the hands of a teacher who works under the same handicap as his own. The more intelligent and apt men are kept as pupil-teachers, and are paid salaries. It may be readily imagined how stimulating must be the effect on a newly blinded man to find his first fumbling efforts directed by one who himself was blinded on the battlefield but a few months ago.

The short hours of work already referred to are another cause for the rapidity with which industries are acquired; another lies in the splendid spirit of cheery determination which pervades St. Dunstan's, and in the fact that these men are, with the exception of the loss of their sight, hale, healthy, normal individuals, differing as a whole widely from the workmen to be found in ordinary institutions for the blind.

Beyond the workshops is situated the poultry-farm. Here an almost untried industry for blind people has been proved to be wonderfully successful. Men are taught poultry-keeping on practical and up-to-date lines. They learn to distinguish birds of different breeds almost instantaneously by touch, to manage incubators and foster-mothers, to prepare and truss birds for table, and generally to conduct a poultry-farm on methods which, if intelligently followed, should insure paying results. The poultry-farm pupils are taught rough carpentry, and learn to make hen-coops, sitting-boxes, gates, etc. The finishing touches are given to the training of blind poultry-farmers by a month at the St. Dunstan's Poultry Farm, near King's Langley. Here is raised the stock of birds of the best breeds which are given to men when they are set up for themselves, and the work of the poultry-farm is carried on by relays of pupils from St. Dunstan's training-grounds. A month spent in this practical work insures the fact that a man when he starts for himself is thoroughly

capable of conducting the business in which he has been trained. They are further assisted by an arrangement which enables their wives, mothers, sisters, or other relative to acquire poultry-farming at a large farm in the country, on the same principles



FIG. 60.—BLINDED SOLDIERS BEING TAUGHT TO IDENTIFY THE DIFFERENT BREED OF FOWLS BY TOUCH.

as those taught at St. Dunstan's. This training is given to relatives free of all charge.

Let us now pass to the three occupations which are taught to the men who possess the highest degree of intelligence, and who have been best educated in the past. First of these comes massage, the one occupation which a thoroughly well trained

blind man is able to follow, not merely as well as, but even better than, a man with sight. The massage training is conducted on the most modern and scientific principles. Men acquire a preliminary knowledge of anatomy, physiology, and pathology at St. Dunstan's itself, and then pass to the massage school of the National Institute for the Blind, a thoroughly up-to-date and well-equipped establishment. Several leading London hospitals permit the more advanced classes to visit daily and massage patients. Testimony has been received from these hospitals as to the value of the assistance thus afforded. The men have to pass the examinations of the Incorporated Society of Trained Masseurs, the most severe in England. So far none have failed, and at the last examinations held a St. Dunstan's graduate passed second of the 320 entrants from all over the United Kingdom, of whom all were sighted except his ten fellow-graduates from St. Dunstan's. A large number of men have become duly qualified masseurs, and have joined the Almeric Paget Massage Corps. The whole of these have situations at military hospitals, where they receive a minimum wage of £2 10s. a week. As an example of their proficiency it may be said that medical officers at hospitals and command depots have stated that the blind men from St. Dunstan's were the most competent members of their massage staffs.

Another of the more intellectual occupations taught at St. Dunstan's is shorthand-writing,

combined, of course, with typewriting in its highest form of development. This seemingly impossible work for the blind is accomplished by means of a clever and quite small machine which enables Braille in its most condensed form to be taken down at a speed equal to that of the ordinary shorthand-writer. Men who learn this art continue their training at St. Dunstan's until they have a speed of well over one hundred words a minute. Those who have been placed in situations are giving entire satisfaction. Here, again, the rapidity with which the art is acquired is most noteworthy.

Telephone operating is the third of the more intellectual occupations taught to the blinded soldiers. The blind telephone-operator cannot, of course, work in public exchanges where the flash-light system is in vogue, but is able to do so in exchanges belonging to large offices and business establishments where the drop-shutter system is installed. Though the shutters are made to pattern and are apparently identical, the blind operator in a few weeks can tell by sound which has fallen, and proves himself to be just as competent as a sighted employee. A good knowledge of Braille-writing as well as of typewriting is a necessary part of the equipment of the blind telephone operator, in order that messages may be taken down and transmitted to various parts of the establishment in which he works.

In every possible case a man is returned to his

original industry or occupation. There have been some very marked instances of success in this direction, and by the adoption of special methods and the teaching of specially devised courses of instruction men have proved themselves capable of continuing their former work in cases where this seemed quite impossible.

The men of St. Dunstan's are taught to play as well as to work. Besides being taken out regularly for walks, they row, they swim, they compete in walking and running races, they learn to dance, and they are taught many indoor games, such as dominoes, draughts, chess, and cards.

Rowing is a great feature of summer life at St. Dunstan's. An arm of the Regent's Park Lake runs into the grounds, and at stated hours in the early morning, in the afternoon, and the evening, the lake is entirely occupied by blind oarsmen accompanied by sighted coxes. The more proficient men are trained by some of the leading experts of the day, and each year compete in four-oared, pair-oared, and single-scuil races on the Thames.

Dancing is an extremely popular amusement. One evening a week is devoted to instruction by competent teachers of those who wish to become really proficient dancers, and on another evening dances are held at the different establishments, to which men are permitted to invite their lady friends. Between the cessation of work and dinner-time one morning in the week a military band plays dance

music indoors in the winter, and on the lawn in the summer. Besides providing admirable exercise, dancing gives the men confidence in moving about and knowledge of the presence of obstacles. Few who see a dance at St. Dunstan's believe that the male partners are unable to see.

The men have a debating society, the sessions of which are well attended.

Almost every man learns some kind of musical instrument, from the humble tin whistle to the piano or violin. Those with any aptitude for singing receive lessons in the art.

The spiritual needs of the men of St. Dunstan's are cared for by an Anglican and a Roman Catholic chaplain. Separate chapels for services in each faith are in the grounds.

St. Dunstan's and its Annexes now (March, 1918) contain about five hundred and sixty men. The London Annexes comprise four large buildings, close round the original house, so generously lent by the American financier, Mr. Otto Kahn, and include Regent's Park College, which has been most kindly placed at the disposal of blinded soldiers.

There is a large convalescent Annexe at Blackheath, and two others at Brighton. To one or other of these men are sent when they first leave hospital, and for periods of rest and recuperation should they be in need of these. At Ilkley in Yorkshire there is an establishment for the permanent care of men who, besides having lost their sight, have received

injuries which make it impossible for them to carry on in the workaday world. Affiliated to St. Dunstan's is Newington House, Edinburgh, an admirable training establishment to which blinded Scottish soldiers are given the option of going.

Four hundred and thirty men have passed through St. Dunstan's. Of this number, 90 per cent. have been fully trained, and have been set up in the occupations which they have learnt. The remainder, for some reason in connection with health or habits, have left partially trained, untrained, or untrainable.

The present quarters provide accommodation for nearly one hundred men in addition to those in residence, and a new establishment, capable of accommodating eighty more, will shortly be ready.

When the training of a man has been completed at St. Dunstan's, he is settled in the industry which he has been taught, is provided with an outfit, and with a good stock of raw material. He is visited regularly, his work is supervised, raw material of the best quality is supplied to him at cost price, and assistance is given in the matter of marketing his goods, either locally or at a central depot. This after-care system is no mere temporary measure, but has been carefully organised upon a permanent basis, and it is anticipated that there will be an adequate sum for its steady maintenance.

The earnings of men who have left vary, of course, greatly, according to industry and aptitude. They average well over £1 a week, and many men are

earning between £2 and £3 a week, while quite a considerable number earn even more than this. Earning capacity is, of course, likely to increase as practice brings increased speed and aptitude.

A very real satisfaction lies not only in the fact that a man is able to augment his pension in so substantial a manner, but that he once more finds himself a capable citizen, competent, self-reliant, and able to regard blindness as it should be regarded—that is to say, not as an affliction, but as a handicap, which, like a keen golfer, he can steadily reduce.

Close to St. Dunstan's are houses at which the relatives of the inmates are entertained free of charge for a week or so at a time. Their journeys to and from London are paid, and the blinded soldiers are thus enabled periodically to enjoy the companionship of those who are near and dear to them.

Officers who have lost their sight do not live at St. Dunstan's. Those who are single reside in Portland Place, while those who are married are provided with flats or apartments in the neighbourhood. Week-end quarters are provided for them at Brighton in the winter, and on one of the upper reaches of the River Thames in the summer. All go to St. Dunstan's daily to learn Braille and type-writing, and some occupation to be pursued for pleasure or profit. Most of them also follow some special course of study.

APPENDIX III

ROEHAMPTON

BY DUDLEY B. MYERS

Hon. Secretary Employment Bureau

WHEN Queen Mary's Convalescent Auxiliary Hospitals, Roehampton, were first projected, it was recognised by the originators of the scheme that to fit a man with an artificial limb was but to half equip him for the struggle for a livelihood which lay ahead of him, and that, in addition to this, it was imperative to do whatever was possible to provide him with suitable employment, and, as a means thereto, to train him, whenever expedient, for work of an industrial nature. It thus came about that the hospitals were established with the dual object of supplying men who had had the misfortune to lose a limb in the war with the best artificial substitutes known to science, and of turning the period of their stay at Roehampton to the most profitable account by preparing them, as far as time and circumstances would permit, for their civil careers. The hospitals were opened for the reception of patients in June, 1915, while two months later an employment bureau was started, and the erection of technical workshops was proceeded with. These

workshops were ready for use by the end of that year, and training operations came into full swing at the commencement of 1916, this being the first practical attempt made in England to deal systematically with the question of men's after-careers while still undergoing treatment in hospital.

The position which had to be faced was undefined, and the work was consequently largely experimental, more especially in its earlier stages. The problem was a new one, the labour conditions were constantly changing, and the difficulties to be contended with were many and great. Under these circumstances it was scarcely to be expected that the initial outcome of the training operations would be very fruitful, especially as the men were more attracted by the many forms of unskilled employment which were available at that time at tempting wages. The idea of training was new to them; they had not learnt to realise the value of the opportunity offered to them, and, moreover, the time spent in hospital was found to be too short to admit of definite results of a practical nature being achieved. These difficulties, however, were gradually overcome; the men were weaned from the attitude of indifference and mistrust which they had assumed at the outset; and, thanks to the generous co-operation of the Polytechnic in Regent Street, the Cordwainers' Technical College, Clark's College, and certain private employers, a system of free after-training was established, the value of which students

were quick to realise, and of which they proved glad to avail themselves on discharge from hospital. It thus fell to purely voluntary enterprise at Roehampton, seconded by the patriotic action of the big institutes referred to, and of other liberal helpers in the cause, to pave the way, free of all cost to



FIG. 61.—DRILLING WORK FOR SUBMARINE FITTINGS.

the men and to the country, to the wide scheme of training operations on a State-supported basis which has since been adopted by the Ministry of Pensions, and in conformity with which all after-training arrangements are now made.

The subjects taught at Roehampton include com-

mercial training, motor mechanism, metal turning and fitting, electricity, wood-working, boot-making and repairing, and basket-making. Training



FIG. 62.—IN THE ELECTRICAL FITTING SHOP.

in light leather work, as also lectures and practical demonstrations on poultry-farming, were given until recently, but were abandoned for want of sufficient support. The most popular forms of after-training

have proved to be motor mechanism, metal turning and fitting (leading to employment under the Ministry of Munitions), electrical work (including cinema operating), boot-making, diamond polishing (an industry newly established at Brighton),



FIG. 63.—WIRING OF ELECTRIC LIGHT FITTINGS.

and commercial instruction. Other trades have attracted, in varying degrees, an analysis of the applications received for training, showing that their character is sufficiently diverse to cover a field of over sixty distinct occupations.

The proportion of men seeking training, in one

part of the country or the other, on discharge from Roehampton, has steadily increased, and has latterly reached the high level of over 25 per cent. This result is far in excess of that obtained elsewhere, and



FIG. 64.—ONE-ARMED MAN REPAIRING ELECTRIC RADIATORS.

must be attributed to the advantage to be gained by handling men collectively and in large groups. The problem at Roehampton, with its large and rapidly circulating flow of men, is unique in the

country. All these men are about to be discharged from the service, and they are all standing on the threshold of a new life, which they are called upon to face under the disadvantage of a grievous handicap. Nevertheless, the outlook for them is an infinitely brighter one than could have been conceived in times of peace, and not only are they making good, but they are, in a very large proportion of cases, steadily going up in the industrial scale, and are earning far higher wages than they were able to before the war.

Up to the end of April, 1918, some 12,000 men, exclusive of officers and Overseas out-patients, had been discharged from Roehampton fitted with their artificial limbs. Of these, approximately 11,000 were handled on an industrial basis, those unaccounted for including men returning to the Dominions and others not needing assistance. No fewer than 46 per cent. of the men returned to their own employment, either by personal arrangement or as the result of applications to previous employers made on their behalf from Roehampton, while training or employment, involving in most cases an entire change of vocation, was arranged for a further 21 per cent. The remaining 33 per cent. were passed on to the local committees to be dealt with, being themselves unwilling to consider work or to accept training except in the vicinity of their own homes. It will thus be seen that only one-third of the men who have passed through the hospitals have

been discharged without some definite occupation in view.

It is interesting to note that the training-classes at Roehampton have attracted no fewer than 5,000 entrants, many of whom, however, did not persevere or were prevented from attending. The increase in the demand for training is best illustrated by the fact that whereas in the whole of 1916 only 400 applications were registered, no fewer than 1,700 have been received during the succeeding sixteen months, or an average of over 100 per month. It is hoped that this high level of demand will be maintained, but fluctuations must necessarily be expected, as the outlook of the men who have been called to the Colours during the later stages of the war has not always been found to be the same as that of the earlier recruits. The problem of the future is, unfortunately, a growing one, necessitating largely increased hospital accommodation; but, whatever the position may prove to be, Roehampton will undoubtedly continue to hold its own as the principal centre devoted to the care of those who have had the misfortune to lose a limb in the service of their country.

APPENDIX IV

ARTIFICIAL LIMBS IN THE UNITED KINGDOM

THE manufacture of artificial limbs for wounded soldiers is almost entirely in the hands of private firms or limited companies. Only at Erskine House, near Glasgow, are limbs made by the hospital authorities and staff.

The first and largest limb-fitting hospital was established at Roehampton, near London, in 1915. Others have since been established at Glasgow, Edinburgh, Belfast, Dublin, and Cardiff.

Arms as well as legs are supplied at all these hospitals, and are paid for by the Ministry of Pensions, while the buildings, staff, and maintenance are provided by charitable funds, helped by capitation grants.

The artificial arms supplied may be roughly separated into two categories—those called “working arms,” and those called, for want of a better name, “mechanical.” As time has gone on, these two types have tended to become combined into one.

A typical “worker’s arm” in its simplest form consists of a bucket, generally of leather and strengthened with steel. This bucket is made no longer than is necessary to hold the stump, and into

a metal socket at the end various useful appliances are attachable.

As a typical "mechanical arm," the Carnes arm may be taken, with movable fingers and rotation and flexion at the wrist. Any uses to which this arm may be put are by means of the fingers, as the hand is not detachable, and no hook or other appliance is attachable.

For most other arms the hand is detachable, and the workers' arms are provided with an ornamental forearm (in the case of upper-arm amputations) and hand.

A very great distinction should be made between prostheses for the forearm and those for the upper arm. In the former case, if the stump is of fair length a very simple bucket and socket suffices. For such cases the Williams arm, with its ingenious spring rotating hook, is perhaps as useful for a labourer as anything.

For the upper-arm amputations or those forearm amputations with too short a stump for the attachment of a bucket, some method of giving control of the artificial elbow-joint is necessary. This is generally obtained by chest or shoulder and opposite arm movements acting through cords or Bowden wires.

While workers' arms enable a labourer in many cases to do almost as well as before his loss, no prosthesis is an efficient substitute for the hand in the occupations requiring delicate manipulation. The

remaining arm and hand must learn, and often does learn, to do the work of two.

The artificial legs supplied are of two types, American and English.

The salient characteristics of the American types are (a) active control of joint movements, aided or not by indiarubber springs and buffers; (b) covering of the limbs with raw hide shrunk on and varnished; (c) reliance in below-knee amputations on accurate fitting round the top of the leg just below the patella, instead of on the thigh corset.

The English type generally has artificial catgut tendons and spiral steel springs in the foot; the knee extension is generally only elastic by means of elastic webbing straps. There is no volitional extension of the knee. In below-knee legs the bucket is not carried up so high as in the American type, and less weight is borne directly upon it.

Most surgeons of large experience are agreed that the American type is the best and most durable. With it the patient can vary his length of pace, which it is difficult to do with the pendulous English type. Also, the active shoulder control enables him to recover from a stumble by extending the knee.

The fact that, of the six existing limb-fitting hospitals in the kingdom, five are supplying almost exclusively the American type, or a limb embodying an adaptation of its principles, speaks for itself.

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Since the above was written more limb-fitting centres have been established by the War Office in various parts of the Kingdom. These are entirely State-supported institutions, but the limbs supplied are made by commercial undertakings at contract prices, and paid for by the Ministry of Pensions. All the important artificial leg-makers have now adopted the principle of active knee control by shoulder action, and most of the other characteristics of the "American" limbs.

August, 1918.

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